

# QUALITY ASSURANCE PROGRAM PLAN ANNETTE ISLAND



prepared for use by:  
Federal Aviation Administration, Alaskan Region  
&  
United States Army Corps of Engineers, Alaska District

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## GLOSSARY OF ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AST	Aboveground Storage Tank
BTEX	Benzene, Toluene, Ethyl Benzene and Xylene
CDOAR	Chemical Data Quality Assurance Report
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
DQO	Data Quality Objectives
DRO	Diesel Range Organic
EDD	Electronic Data Deliverable
EM	Engineering Manual
EPA	United States Environmental Protection Agency
FID	Flame Ionizing Detector
GAC	Granulated Activated Carbon
GCMS	Gas Chromatograph/Mass Spectrometer
GRO	Gasoline Range Organic
HTRW	Hazardous and Toxic Regulated Waste
IDW	Investigation Derived Waste
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MIC	Metlakatla Indian Community
MS	Mass Spectrometer
PAH	Polynuclear Aromatic Hydrocarbons
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCB	Polychlorinated Biphenyls
PE	Professional Engineer
PID	Photo Ionization Detector
PLM	Polarized Light Microscopy
PVC	Poly Vinyl Chloride
QA	Quality Assurance
QAP	Quality Assurance Plan
QAPP	Quality Assurance Program Plan
QC	Quality Control
RPD	Relative Percent Difference
RRO	Residual Range Organic
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TCLP	Toxicity Characteristic Leaching Procedure
URL	Universal Reference Locator

USACE/COE	United States Army, Corps of Engineers
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
WP	Work Plan

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# STANDARD SAMPLING PROCEDURES

## SECTION 1. PROGRAM DESCRIPTION

### 1.1 Program Objectives

This Quality Assurance Program Plan (QAPP) includes requirements and techniques for generating analytical data to be used by federal agencies conducting cleanup activities on Annette Island to meet the Metlakatla Indian Community (MIC) cleanup standards. It does not include data quality objectives (DQO) and data requirements specifically for collecting data to be used in risk assessments. However, data generated according to this QAPP should be of the quality required for risk assessment purposes. Additional or other project and site-specific data requirements and quality objectives may be required for each individual project if data requirements and quality objectives are more stringent than data requirements and quality objectives included in this QAPP.

This QAPP outlines the standard operating procedures, quality control procedures, and data quality objectives for removals underground storage tanks (USTs), aboveground storage tanks (ASTs), pipelines, drums, etc., contaminated site characterizations, site assessments, release investigations, and remedial actions. It provides direction regarding collecting, interpreting, and reporting data. The data will enable the federal agencies and the MIC to evaluate the presence, degree, and extent of any groundwater, surface water, sediment, or soil contamination and to determine if further action is necessary. The term "assessment firm" wherever used in this QAPP, refers to contractor(s) hired by a federal agency to conduct contracted activities.

Data quality objectives for analytical samples include ensuring all analytical data is of sufficient quality to allow for: determining if established MIC cleanup levels and non-MIC regulatory standards are met; determining if wastes meet the definition of a hazardous waste; and transportation and disposal of those wastes. Analytical data must also meet the established PARCC parameters defined in Section 3.1. Data quality objectives (DQO) for field-screening are to: direct remedial actions, qualitatively determine hot spots, identify analytical sampling locations and unknown wastes. Project specific DQOs will be included in each project Sampling and Analysis Plan (SAP) or work plan (WP), and will detail the targeted screening and cleanup levels and other data uses for the project. The project chemist will evaluate all data based on standard technical data review guidance to determine if the data are valid and meet the project DQOs. The process for project DQOs development is included

in the Corps of Engineers *Engineer Manual EM 200-1-2, Technical Project Planning Process* (<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em200-1-2/toc.htm>).

Addendums to this QAPP may be added as needed to meet project needs or requirements.

## 1.2 Program Approach

To meet program objectives, this QAPP outlines a systematic approach to conducting site assessments and investigations. This approach is based on scientific studies, United States Environmental Protection Agency (EPA) guidance and methods, Alaska's UST regulations in 18 AAC 78 for using Alaska analytical methods, guidelines, and assessment strategies used in Alaska and other states, and Army Corps of Engineers chemical quality assurance requirements. This QAPP details sampling, laboratory analysis, and data reporting procedures, along with all required quality control functions. The QAPP covers activities in the following areas:

1. Personnel and responsibilities;
2. Data quality objectives;
3. Sampling procedures;
4. Sample transfer log;
5. Laboratory analytical procedures;
6. Equipment maintenance and calibration;
7. Data reduction, validation, and reporting;
8. Quality control checks;
9. Precision, accuracy, and completeness assessments;
10. Corrective action scenarios;
11. Internal audits; and
12. Reporting to management.

Information about site sampling locations and site history, with reference to any existing documents for historical information and data available, must be included in each site-specific project work plan or report submitted for each project undertaken for which a plan is required.

## SECTION 2. PROGRAM ORGANIZATION AND RESPONSIBILITIES

### 2.1 Personnel and Responsibilities

A qualified person, as defined by the Alaska Department of Environmental Conservation, shall conduct and/or supervise all activities, including data collection, interpretation, and reporting. A qualified person is a person experienced in sampling, interpretation of data, and preparing plans and reports. The qualified person must have at least three years of professional experience in the above tasks. Reports and plans must identify the assessment firm's key personnel including the project manager and the quality assurance (QA) officer. One person may not perform both the project management and quality assurance officer tasks. The responsibilities for these tasks under this chapter are as follows:

- (1) The assessment firm's project manager is responsible for overall management of the site assessment and site investigation program, including adhering to the procedures outlined in this chapter.
- (2) The assessment firm's QA officer is responsible for overall quality assurance of the assessment firm's field and analytical programs. The QA officer is responsible for conducting scheduled field audits and providing ongoing review, monitoring, and evaluation of the field and laboratory activities.

### 2.2 Accountability

While a laboratory must assure satisfactory levels of quality control within the laboratory to maintain its status with the USACE and ADEC, the data user shall ensure the assessment firm:

- (1) Verifies the status of the laboratory being used (a list of certified and provisionally approved laboratories is available from the Corps and/or ADEC);
- (2) Ensures that analytical testing meets the objective of this chapter referring to laboratories;
- (3) Reports any deviation(s) from standard laboratory procedures of which it becomes aware; and
- (4) Takes appropriate corrective actions as outlined in Section 10 of this QAPP if questions or problems with the laboratory analysis arise.

## SECTION 3. FIELD QUALITY ASSURANCE

### 3.1 Responsibility and Definitions

The assessment firm has primary responsibility for field QA and is accountable for overall sample QA. The laboratory QA manager shall evaluate the laboratory-established control limits internally at regular intervals, and scheduled control measurements will be taken to detect trends and out-of-limit values. The laboratory will maintain records of these activities. The laboratory must perform corrective actions when its established limits are not within those of the published method. The method detection limit studies will be performed according to 40 Code of Federal Regulations (CFR) 136, Appendix B.

Calculation of the method detection limit is discussed in the Corps of Engineers *Engineering Manual EM 200-1-3 "Requirements for the Preparation of Sampling and Analysis Plans"* (<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em200-1-3/a-b.pdf>) Section B-9. QA objectives are determined on a site-specific basis for each project based on the following:

**Precision.** Precision is defined as the agreement between repeated measurements of the same parameter under similar conditions regardless of the true value. Therefore, precision represents the repeatability of the measurement. The precision of a series of measurements can be expressed as RPD. Precision between replicate samples can be determined by calculating the RPD between analytical results for the replicates using the following formula:

$$RPD = 100 \times (R1 - R2) / ([R1 + R2] / 2)$$

Where:

RPD	=	relative percent difference;
R1	=	original sample value; and
R2	=	replicate value.

The matrix spike/matrix spike duplicate will be evaluated (one set per 20 samples per matrix) to determine the precision of the sampling and analytical methods and to determine matrix interferences. The laboratory control sample(LCS)/laboratory control sample duplicate (LCSD) will be evaluated to determine the precision of the laboratory procedures and verify matrix interference. Field replicates may also be evaluated for sampling and analytical variability (error) and the non-homogeneity of the sampled source.

**Accuracy.** Accuracy is the closeness of agreement between an analyzed value and a true or accepted value. Accuracy measurements will be performed for matrix spike and LCS. Accuracy will be statistically represented by calculating percent recovery of the known

concentration of the analyte in the sample. Percent recovery will be calculated as follows:

$$\% R = 100 \times (x_s - x_u)/K_s$$

Where:

% R	=	percent recovery;
$x_s$	=	measured value of the spike in the sample; and
$x_u$	=	measured value of the unspiked sample; and
$K_s$	=	known value of the spike in the sample.

**Representativeness.** Representativeness is qualitative measures of the sampling protocols that reveal how well the collected samples represent the chemical characteristics of that medium. Sample handling protocols (e.g., storage and transportation) have been selected to protect the representativeness of the collected sample. Measurements will be made so that results are as representative of the medium as possible. Proper documentation will establish that protocols have been followed and sample identification and integrity are ensured.

Representativeness of specific analyses will be achieved by the following means:

- (1) Selecting appropriate numbers of samples and locations to adequately characterize the actual and current site conditions;
- (2) Using appropriate sample procedures and equipment;
- (3) Selecting appropriate analytical methodologies that provide required detection limits;
- (4) Analyzing the appropriate number and type of QC samples to statistically verify proper functioning of the analytical method and equipment, and the applicability of the methodology and laboratory procedures;
- (5) Documenting sampling activities and sampling locations in field logs, on COC records, and in logbooks that are signed and dated by sampling and analysis personnel; and
- (6) Using appropriate equipment decontamination techniques.

**Comparability.** Comparability is a qualitative characteristic that defines how consistent chemical data results are when compared with other field sampling efforts. To ensure data set comparability, the following steps will be taken:

- (1) Instruments will be operated within their calibrated range according to established procedures that are based on approved methodology. Analyses will be performed using standard EPA and ADEC methods.
- (2) Measurements that appear to be outliers will be reassessed. The determination of outliers will be based on assessing a statistically significant data set. Not all outlier data are a result of analytical error or sampling technique. No data will be

eliminated because of lack of comparability. However, these data will require explanation. The locations of outliers will be investigated immediately before notifying of the Contractor project chemist.

- (3) Only standards supplied by the field test kit manufacturer with each test kit will be used for field-screening analysis. Data will be reported in conventional and standard units.

**Completeness.** Completeness is a quantitative evaluation (expressed as a percentage) of the overall data quality of the results generated and is calculated as follows:

$$\%C = (V/T) \times 100\%$$

Where:

%C = percent completeness;

V = number of measurements judged valid; and

T = number of valid measurements needed to achieve a specific statistical level of confidence.

**Sensitivity.** The analytical systems and procedures shall be developed so that sensitivity provides analytical reporting limits that are less than screening, cleanup, or other appropriate action limits. The sensitivity is dependent upon the project-specific DQO.

Valid screening data are all data which meet all acceptance criteria (includes estimated data) as specified in this QAPP. Data produced by the field test kit analyses should achieve completeness of greater than or equal to 90 per cent. Laboratory data should achieve completeness of 95 per cent or greater.

## SECTION 4. SAMPLING PROCEDURES

### 4.1 Overview of Sampling Approach

The systematic sampling approach outlined below must be used to ensure data collection activities provide usable data.

- (1) Sampling must begin with an evaluation of background information, historical data, and site conditions. This evaluation is used to prepare a site-specific sampling strategy;
- (2) Results of the pre-sampling investigation and field-screening results must be used to determine where samples will be collected. Field-screening results may also be used to segregate soils, based on apparent levels of contamination, to help monitor potential exposures, and for health and safety monitoring. However, field-screening may not take the place of required laboratory samples as discussed in Section 4.5;
- (3) Samples must be collected with appropriate, clean tools. Sampling equipment decontamination must follow the practices described in this section;
- (4) If necessary, sufficient monitoring and observation wells must be properly installed to determine the presence, degree, or extent of groundwater contamination. Sampling of groundwater must follow the standard procedures outlined in Section 4.7;
- (5) Samples must be collected and preserved in appropriate sample containers, as listed in Table 1 (Appendix A); and
- (6) PCB sampling must be conducted in accordance with the current EPA regulations (40 Code of Federal Regulations 761, 1998).

### 4.2 Documentation of Sampling Procedures

A field log book or another type of field record must be used to document the collection of samples and site data. This record must include at a minimum:

- (1) The name of each qualified person on site supervising or conducting a characterization, assessment, or investigation;
- (2) The date and time of sampling;
- (3) Weather conditions, including temperature, wind speed, humidity, and precipitation;
- (4) The name of each person who physically collected the samples;
- (5) Purpose of the sampling;
- (6) Location of the sampling site;

- (7) Sample media and description;
- (8) Type and number of samples collected;
- (9) Results of an inspection of the tank, piping, or drums for corrosion;
- (10) Use of waterproof ink and single line correction;
- (11) Date of entry;
- (12) Name and affiliation of every person on site, including visitors;
- (13) General description of each day's activities;
- (14) Field equipment calibration;
- (15) Sampling equipment and sampling method documentation;
- (16) Field measurements such as air monitoring;
- (17) Sample type (split, composite, etc);
- (18) Sample shipment;
- (19) Field filtering of water samples;
- (20) Sample preservatives;
- (21) QC samples identification and description;
- (22) Deviations from the QAPP or SAP;
- (23) Signature on the bottom of each page;
- (24) A site sketch (which except for sampling locations, may be prepared prior to going in the field) that, at a minimum, shows:
  - (a) Locations of all known present and past tanks, piping and pump islands, and other contaminated areas;
  - (b) Distances from tanks, pipelines, drums, and/or contaminated areas to nearby structures;
  - (c) Property line locations (based upon best available information);
  - (d) Sampling locations, depths and corresponding sample ID numbers;
  - (e) Any release sites;
  - (f) Any free product sites;
  - (g) Scale; and
  - (h) North arrow.
  - (i) When appropriate, the site sketch should include the following relevant features:
    - (A) Description of the size of the excavation;
    - (B) Location of stockpiled soils;
    - (C) Depth, width, and type of backfill material used to surround tanks and piping;
    - (D) Soil types;
    - (E) Utility trenches;
    - (F) Wells within 100 feet;
    - (G) Depth to groundwater or seasonal high groundwater level; and
    - (H) Surface drainages, including potential hydraulic connections with groundwater.

## 4.3 Pre-sampling Activities

Before conducting field-sampling activities, a site background information review and an inspection of site conditions will be performed to determine potential sampling locations. Exact sampling locations will be determined in the field based on the results of these activities, field observations, accessibility, historic information, and aerial photographs. More specific information is provided in Sections 4.3.1 and 4.3.2.

### 4.3.1 Site Background

Before beginning field work the following historical information must be collected, recorded and, where relevant, incorporated into Sampling and Analysis Plans or Work Plans, if possible:

- (1) History of known releases and available data from previous soil or groundwater sampling at the site;
- (2) History of building operations and other storage areas;
- (3) Depth to groundwater or seasonally high groundwater level;
- (4) Surface waters and wetlands in the immediate vicinity of site;
- (5) Type and classification of native soil;
- (6) Property line locations;
- (7) Type and location of below ground utility lines that could create pathways for contaminant migration;
- (8) History of types of products stored in the tanks, pipelines, and drums;
- (9) Description of known past and present petroleum systems/tanks, including capacity, dimensions, age, and material of construction as well as location and types of fill and vent pipes, valves, and connectors; and
- (10) Distances from tanks, pipelines, drums, and other storage or contaminated areas to nearby structures and surface water.

In addition, where relevant and practical, the following information on the site must be collected and recorded:

- (1) Surface drainage characteristics, including potential hydraulic connections with groundwater;
- (2) Locations of stained soil and stressed vegetation;
- (3) Location of each tank hold-down pad or anchoring system, if any;
- (4) Depth and width of backfill area and type of backfill material used to surround tanks and piping; and
- (5) Location of other nearby tanks, either active or inactive, or other potential sources of contamination.

### 4.3.2 Observation of Site Surface Conditions

A site surface observation must be conducted before sample collection to assist in determining field sampling approaches and locations. Activities that must be completed during this observation include:

- (1) Locating the aboveground components of each tank, pipeline, drum or other structure;
- (2) Confirming the amount of fuel currently in each container;
- (3) Determining tank or pipeline size;
- (4) Observing aboveground utilities;
- (5) Underground utility locations (contact utility location centers where available);
- (6) Visual inspection for surface indications of releases;
- (7) If practical and no safety hazards exist, check for odor of contamination in nearby structures (basements); and
- (8) Check sumps and access manholes for evidence of contamination.

Key areas that must be evaluated for surface indications of a release include:

- (1) Vent pipes and fill holes, exposed drums or other metal debris, building debris;
- (2) Pavement depressions, buckling, cracks, or patches that could indicate subsurface problems have historically occurred;
- (3) Cracks or stains at base of pumps;
- (4) Evidence of stressed vegetation that may have resulted from a release or spill; and
- (5) Soil staining.

The results of the site observations must be recorded in a field logbook or other appropriate document.

## 4.4 Field-Screening

Field-screening is the use of portable devices capable of detecting contaminants on a real-time basis or by rapid field analytical technique. The manufacturer's instructions included with the test kit or screening device must be followed to create valid data. Calibration and maintenance of the screening device or test kit must be conducted according to the manufacturer's instructions. To help ensure valid results with field-screening equipment, duplicate samples will be analyzed at a frequency of 10% for each media being screened, and the field-screening equipment will analyze one method blank at a frequency of 10% for each media being screened. Additionally, laboratory analyses will be performed on 10% of the field screened samples, except for samples screened using a photoionization detector (PID),

flame ionization detector (FID), ENSIS or other field-screening technologies that have been reviewed and accepted by the EPA and/or ADEC. Both positive and negative field-screening results will be included as field-screening duplicates and laboratory samples. The project chemist will be responsible for checking the field-screening results and taking any necessary corrective actions to provide reliable field-screening data.

Field-screening must be used to help assess the locations where contamination is most likely to be present and to segregate soils during excavation. For tank areas this includes areas of suspected or obvious contamination, adjacent to and below all fill and vent pipes, excavation sidewalls below the tank midline, and representative samples from the excavation bottom. For pipe runs and pipelines this includes areas of suspected or obvious contamination, below piping joints, elbows, connections, and damaged piping components; if these locations are unknown, screening must occur below original level of piping and adjacent to and below all dispensers.

When possible, field-screening samples should be collected directly from the excavation or from the excavation equipment's bucket. If field-screening is conducted only from the equipment's bucket, a minimum of one field-screening sample must be collected from each 10 cubic yards of excavated soil. If instruments or other observations indicate contamination, soil must be segregated into stockpiles based on apparent degrees of contamination. At a minimum, soil suspected of contamination must be segregated from soil observed to be free of contamination. Two levels of field-screening procedures are:

- (1) Use of field-screening devices to perform synoptic surveys of potentially contaminated areas to determine the approximate locations containing contaminants (qualitative screening); or
- (2) Use of field-screening devices to provide a semi-quantitative estimate of the amount of contaminant present at a specific location (semi-quantitative screening).

#### 4.4.1 Field-screening Devices

Many field-screening instruments are available for detecting petroleum, PCBs, and other contaminants in the field on a rapid or real-time basis. Acceptable field-screening instruments must be suitable for the contaminant being screened. The procedure for field-screening with PIDs and FIDs is described in Section 4.4.2. Other EPA, ADEC and industry-accepted field-screening methods, equipment and technologies may be used with prior approval of the contracting federal agency. Whichever field-screening method is chosen, the accuracy of the method must be verified throughout the sampling process using appropriate standards to match the use intended for the data. Instrumental or analytical methods of detection must be used, not olfactory or visual screening methods.

#### 4.4.2 Headspace Analytical Screening Procedure for Field-screening (semi-quantitative field-screening)

The most commonly used field instruments for petroleum assessments are FIDs and PIDs. The following headspace screening procedures for obtaining and analyzing field-screening samples must be adhered to when using FIDs and PIDs:

- (1) Partially fill (one-third to one-half) a clean jar or clean re-sealable airtight bag with the sample to be analyzed. Total capacity of the jar or bag may not be less than eight ounces (app. 250 ml), but the container should not be so large as to allow vapor diffusion and stratification effects to significantly affect the sample.
- (2) If the sample is collected from a split spoon, it must be transferred to the jar or bag for headspace analysis immediately after opening the split-spoon. If the sample is collected from an excavation or soil pile, it must be collected from freshly uncovered soil.
- (3) If a jar is used, its top must be quickly covered with clean aluminum foil or a jar lid. Screw tops or thick rubber bands must be used to tightly seal the jar. If a re-sealable airtight bag is used, it must be quickly sealed shut.
- (4) Headspace vapors must be allowed to develop in the container for at least 10 minutes but no longer than one hour. Containers must be shaken or agitated for 15 seconds at the beginning and end of the headspace development period to assist volatilization. Temperatures of the headspace must be warmed to at least 40° F (approximately 5° C); with instruments calibrated for the temperature used.
- (5) After headspace development, the sampling probe must be inserted to a point about one-half the headspace depth. The container opening must be minimized and care must be taken to avoid uptake of water droplets and soil particulates.
- (6) After probe insertion, the highest meter reading must be taken and recorded, which normally will occur between two and five seconds after probe insertion. If erratic meter response occurs at high organic vapor concentrations or conditions of elevated headspace moisture, a note to that effect must accompany headspace data.
- (7) Calibration of PID and FID field instruments must follow the procedures outlined in Section 7.1
- (8) All field-screening results must be documented in the field record or log book.

#### 4.4.3 Other Field-screening

Field immunoassay test kits can screen soils and non-porous surfaces. These semi-quantitative

test kits may be used to identify areas of contamination to aid in removals and to identify analytical sampling locations.

## 4.5 Determining Sample Locations

Field-screening results will be used to determine the location from which to obtain samples. Samples must be obtained from locations that field-screening and observations indicate are most heavily contaminated. A positive field-screening result is one in which any deflection in the meter reading occurs at locations where samples are required. Samples analyzed with field-screening devices may not be substituted for required laboratory samples. Within the constraints for sampling locations listed above, laboratory samples must be taken where contamination is most likely to be present.

### 4.5.1 Sample Locations for Contaminated Untreated Stockpiles

Field-screening will be used to segregate soils during excavation based on apparent degrees of contamination.

Characterizing stockpiled soil is necessary to determine whether soil treatment or disposal is needed, to assist with selection of treatment or disposal methods, and to establish baseline data for use in evaluating the effectiveness of treatment.

To determine if untreated stockpiled soils can be disposed of or considered not contaminated, stockpiled soils must be characterized by using the following procedures:

- (1) Field-screening samples must be obtained from various depths in the pile, but none less than 18 inches beneath the exposed surface of the pile. Field-screening must follow the procedures outlined in this section and results must be documented in a site logbook. Section 4.4 and 18 AAC 75 field-screening requirements must be met.
- (2) Analytical samples must be obtained from various depths in the pile, but none less than 18 inches beneath the exposed surface of the pile.

Sampling of contaminated stockpiles will be conducted in accordance with the analytical requirements of the proposed treatment or disposal facility and as necessary to meet Department of Transportation Hazardous Material Transportation requirements.

### 4.5.2 Alternative Sample Collection Procedures

Alternative sample collection procedures, such as Cone Penetrometer Testing, HydroPunch and Borehole Geophysical Logging may be used to determine soil hydrogeologic

characteristics, contaminant distribution, and contaminant concentration.

These procedures may be useful, with proper evaluation, in providing essential data to assess and delineate the extent of contamination during site characterizations, release investigations, and remedial actions. Alternative procedure analytical results may not be used in collecting samples for final verification during site assessment or remedial activities.

#### 4.5.3 Sample Locations for Treated Excavated Soils

To determine if excavated soil has been adequately remediated, final remedial action verification samples must be collected from the location and depth of areas showing the highest levels of contamination during field-screening.

At least one field-screening sample must be obtained from each 10 cubic yards of treated soil. Field-screening samples must be obtained from various depths, but not less than 18 inches beneath the exposed surface of the soil. Field-screening must follow the procedures outlined in this section and the results must be documented in a site logbook.

The number of grab samples collected from the treated soil must be as required by the MIC regulations.

### 4.6 Collecting Soil Samples

The following procedures must be used to collect soil samples for laboratory analysis:

- (1) All soil samples collected for VOC and petroleum contaminants must be grab samples and may not be composited before analysis. Soil samples for total metals, PCBs, and semi-volatiles may be composited in the field or in the laboratory before analysis.
- (2) Soil samples taken directly from the surface of excavations must be obtained from freshly uncovered soil. A minimum of six inches of soil must be removed immediately before collection, and the sample must be obtained from the newly uncovered soil. If the excavation has been open for longer than one hour, at least 18 inches of soil must be removed immediately before collection.
- (3) Soil samples for contaminants deposited directly onto the soil surface (lead paint chips, asbestos fibers, etc.) must be collected within the top two inches of the ground surface.
- (4) Soil samples collected from excavation equipment buckets must be obtained from the center of the bucket and away from the bucket sides. At least six inches of soil must be removed immediately before collection.
- (5) If soil samples are collected from a soil boring, samples should be collected using

a hollow stem auger and split spoon sampler/Shelby tube. When using an auger, the drill hole must be advanced to the desired depth; the center rods of the auger must be withdrawn from the drill hole, and the plug and pilot bit removed from the center rods. The sampler must be attached to the correct length of drill rod and must be driven ahead of the auger flights in order to collect a relatively undisturbed sample. After the split spoon or Shelby tube has been retrieved from the boring, the desired sample section must be immediately removed from the sampling device. Only soil from the middle portion of the spoon should be collected for samples. Soil from the very ends of the spoon must be discarded as it often contains disturbed soils. A clean sampling tool must be used to quickly collect the sample from the undisturbed portion with a minimum of disturbance and the sample container must be quickly capped, sealed, and labeled.

- (6) Soil samples for all parameters listed in Table 1 (Appendix A) must be collected in accordance with method specifications.

The following steps must be taken to minimize collection errors:

- (1) All samples must be collected with disposable or clean tools that have been decontaminated as outlined in Section 4.10.
- (2) Disposable gloves must be worn and changed between sample collections.
- (3) Sample containers must be filled quickly.
- (4) Soil samples must be placed in containers in the order of volatility; for example, volatile organic aromatic samples must be collected first, gasoline range organics next, heavier range organics next, inorganics, and soil classification samples last.
- (5) Containers must be quickly and adequately sealed, and rims must be cleaned before tightening lids. Teflon tape may be used to secure container lids. Electrical tape or other tapes containing volatile or semi-volatile components shall not be used due to possible effects on sample analysis.
- (6) Sample containers must be labeled as outlined in Section 4.11.2.
- (7) Containers must immediately be preserved according to procedures in Section 4.11.3. Unless specified otherwise, the samples must be immediately cooled to  $4^{\circ} \pm 2^{\circ} \text{C}$  and this temperature must be maintained from sample collection to laboratory analysis.

#### 4.7 Obtaining Groundwater Samples from Borings/Wells

Groundwater samples may be required if contamination is suspected. Water sampled directly from an excavation is not necessarily representative of normal groundwater conditions and will not be evaluated as a representative groundwater sample. In such cases, installation and sampling of a groundwater monitoring well may be required. Procedures for installation,

construction, and development of monitoring wells will follow USACE guidelines, *EM 1110-1-4000, Monitoring Well Design, Installation and Documentation at Hazardous, Toxic and Radiological Waste Sites* (<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-1-4000/entire.pdf>). These procedures will be provided in project specific planning documents.

If groundwater is to be analyzed for dissolved metals, the samples shall be field filtered through a 0.45-micron filter to prevent suspended sediments from introducing false positive results. This filtering will allow the analysis to report dissolved metal concentrations, not total concentrations. Monitoring wells containing turbid water shall be sampled using methods to reduce the suspended solids.

#### 4.7.1 Sampling Groundwater Monitoring Wells

If multiple wells are sampled, the uncontaminated up-gradient wells should be sampled first to minimize potential cross-contamination. Before sampling wells, the depth to groundwater must be determined by manual or electronic means. Measurement devices must be calibrated before use to an accuracy of at least 0.01 foot.

##### 4.7.1.1 Determining Well Depth and Presence of Non-aqueous Phase Liquids

Before sampling a monitoring well, the column of water in the well casing must be checked for the presence of non-aqueous phase liquids, including free petroleum products that might be floating on top of the water or in a separate layer at the bottom of the casing. Non-aqueous phase liquids are identified by:

- (1) Carefully lowering a clean bailer, in a manner that will create minimum disturbance, into the well before purging and observing the liquids removed from the top and the bottom of the water column;
- (2) Using a paste type of detector with ingredients that will not lead to cross-contamination;
- (3) Using an electronic device designed to detect non-aqueous liquids and to measure the thickness of the non-aqueous layer.

The volume of free product may be estimated using methods identified in *EPA 510-R-96-001, How To Effectively Recover Free Product At Leaking Underground Storage Tank Sites* ([http://www.epa.gov/swerust1/pubs/fpr\\_c1&2.pdf](http://www.epa.gov/swerust1/pubs/fpr_c1&2.pdf)).

If free product is present, the well must be bailed or pumped until free product is no longer present, then must be monitored to evaluate the recharge rate. Free product recovered during bailing of the well shall be containerized and disposed of in accordance with the

Waste Management Plan (WMP).

#### 4.7.1.2 Well Purging

Monitoring wells must be purged before sampling using the following procedure (or an equivalent):

- (1) At least three casing volumes of water must be removed from the well before sample collection. For low yield wells, until the well bore is evacuated; or instead of purging three casing volumes, measure the purge water temperature, pH, and conductivity until these parameters are stable to within 10 percent variability between measurements for conductivity, 0.2 units for pH, and 0.2 degrees for temperature;
- (2) All purged water must be carefully collected, containerized, and stored for proper disposal pending evaluation of groundwater sample analyses. The results of the analyses and the applicable federal, state, and local water quality criteria must determine the acceptable method for disposal of the purge water;
- (3) Up-gradient wells should be purged before down gradient wells to help minimize possible cross contamination.

#### 4.7.1.3 Collecting Groundwater Samples with Bailers

If a bailer is used to collect samples, the following procedure must be used:

- (1) After purging the well, sufficient time must be allowed for the well to equilibrate and fines to settle; if full recovery exceeds two hours, samples must be extracted as soon as sufficient volume is available;
- (2) The water level must be re-measured after purging has occurred and water level has returned to the static level;
- (3) If decontaminated equipment is used to collect the water sample, the sampler must be rinsed with analyte-free distilled or deionized water. A portion of this rinsate must be collected into a container appropriate for the most volatile analyte suspected (e.g. BTEX). This equipment blank (decontamination blank) must be collected, preserved, and analyzed according to the procedures outlined in this chapter for that analyte;
- (4) Bailers must be made of Teflon, stainless steel, other suitable materials, or of disposable materials such as Teflon or polyethylene; polyvinyl chloride (PVC) bailers are not acceptable for sampling volatile organic compounds; all bailers must be decontaminated as outlined in Section 4.10;
- (5) The bailer must be fitted with a new bailer line for each well sampled; only personnel wearing decontaminated or disposable gloves may handle the bailer

- and line;
- (6) The bailer should be slowly lowered to minimize disturbance of the well and water column. The bailing line should be prevented from contact with the outside of the well, equipment, and clothing. Special care must be taken to minimize disturbance of the water table interface when inserting the bailer;
  - (7) Samples must be obtained as close as possible to the water level/air interface, unless analysis indicates that contamination is at a different depth;
  - (8) Water samples must be grab samples;
  - (9) The bailer must be slowly lifted and the contents transferred to a clean sample container with a minimum of disturbance and agitation to prevent loss of volatile compounds. If different analytes are sampled, samples must be transferred to containers in the order of their volatility. Volatile compounds must be collected first, followed in order, by gasoline range organic compounds, inorganic compounds, heavier range organic compounds, and metals. Headspace in the sample container must be minimized by filling the sample jar until a positive meniscus is present. Containers must be quickly and adequately sealed. Rims must be cleaned before tightening lids;
  - (10) Sample containers must be labeled as outlined in Section 4.11.2; and
  - (11) Containers must be preserved immediately according to procedures in Section 4.11.3. Samples must be immediately cooled to  $4^{\circ} \pm 2^{\circ} \text{C}$  and this temperature must be maintained through delivery to the laboratory until the samples are analyzed.

#### 4.7.1.4 Alternative Methods of Collecting Groundwater Samples

If a positive displacement pumping system or another system is used instead of a bailer, it must be clean or decontaminated as described in Section 4.8. Disturbance of the well, water column, and samples must be minimized. Only grab samples may be obtained, not composite samples. The procedures detailed above shall be used for sampling.

### 4.8 Collecting Surface Water Samples

Surface water sample collection will follow the guidance contained in the Corps of Engineers publication EM 200-1-3, *Requirements for the Preparation of Sampling and Analysis Plans*, Section C-3. This document is available at <http://www.usace.army.mil/inet/usace-docs/eng-manuals/em200-1-3/a-c.pdf>.

## 4.9 Collecting Sediment Samples

Sediment sample collection will follow the guidance contained in the Corps of Engineers publication EM 200-1-3, *Requirements for the Preparation of Sampling and Analysis Plans*, Section C-5. The URL to section C-5 is <http://www.usace.army.mil/inet/usace-docs/eng-manuals/em200-1-3/a-c.pdf>. Further, sediment sampling and analytical information is available in the Addendum to the QAPP, Addendum Table 4, Recommended Sample Preparation Methods, Cleanup Methods, Analytical Methods and Detection Limits for Sediments.

## 4.10 Decontaminating Field Equipment

Decontaminating of personnel, sampling equipment, and containers before and after sampling must be performed to ensure collection of representative samples and to prevent the potential spread of contamination. Personnel decontamination prevents ingestion and absorption of contaminants and must include a soap and water wash and deionized or distilled water rinse.

All previously used sampling equipment must be properly decontaminated before sampling and between sampling locations to prevent introduction of contamination into uncontaminated samples and to avoid cross-contamination of samples. Cross-contamination can be a significant problem when attempting to characterize extremely low concentrations of organic compounds or when working with soils that are highly contaminated.

Persons decontaminating tools and equipment must wear clean, solvent-resistant gloves and appropriate protective equipment.

### 4.10.1 Decontamination of Soil Sampling Tools

Drill auger sections, split spoons, drive hammers and other sampling tools that come in contact with soil or water in a bore hole must be cleaned before use and between borings using the following three-step procedure:

- (1) Tools must either be:
  - (a) Scrubbed with a stiff brush in a solution of water and laboratory grade, critical cleaning detergent such as Alconox or a similar product; and
  - (b) Cleaned with high-pressure hot water or steam and a laboratory grade, critical cleaning detergent.
- (2) Tools must be rinsed twice in clean water; and
- (3) Tools must be thoroughly rinsed with distilled or deionized water.

If concentrated petroleum products or highly contaminated soils are encountered during sampling, an appropriate solvent should be used to remove heavy petroleum residues from the sampling tools. PCB sampling equipment must be further decontaminated using a rinse of alcohol followed by a rinse with distilled or deionized water. High concentrations of metals may require additional decontamination with nitric acid followed by a rinse with distilled or deionized water. This must be followed by the minimum cleaning procedure outlined above.

If a solvent is used, it must be properly collected, stored, and disposed of according to acceptable hazardous waste disposal guidelines. The use of solvents must be in an area that will not affect the sampling activities or equipment storage areas and contaminate samples or equipment.

#### 4.10.2 Decontamination of Water Sampling Tools

Steel measuring tapes, well sounders, transducers, and water quality probes must be rinsed with clean water and then with deionized water.

Reusable bailers must be washed in Alconox or another laboratory grade, critical cleaning detergent solution, rinsed twice in clean water, and then rinsed with distilled or deionized water. In PCB and metal contaminated groundwater, all equipment contacting the groundwater requires additional decontamination with an alcohol rinse or nitric acid rinse respectively.

#### 4.10.3 Decontamination of Excavation Equipment

Excavation equipment shall be cleaned off site using a high pressure, low volume water spray or steam cleaned prior to field activities. Additionally, critical excavation equipment components shall be cleaned before each site excavation begins as described in Section 4.10.2. A designated area will be used for decontamination of larger pieces of equipment as necessary. Decontamination fluids shall be containerized for disposal purposes. Visible soil

adhering to the equipment shall be removed prior to the equipment entering or leaving a site and containerized for disposal purposes.

#### 4.10.4 Cleaning Sample Containers

Sample containers must be cleaned and prepared by an analytical laboratory. The exterior of sample containers must be cleaned after the samples are collected and the container lids are tightly sealed. Solvents may not be used for this procedure because of the potential to contaminate the sample. It is preferable to use new pre-cleaned certified sample containers rather than washing containers in the laboratory.

#### 4.10.5 Disposal of Wash Water, Rinsate, and Disposable Sampling Tools

Wash water and rinsate solutions must be collected in appropriate containers and disposed of properly in accordance with federal and local MIC regulations. Bailing strings and wires and other disposable sampling tools must be properly discarded after use at each well. Wash water and rinsate may be disposed of through granulated activated carbon (GAC) filters with MIC concurrence and if the water meets requirements for GAC usage.

### 4.11 Sample Containers and Holding Conditions

Containers used to collect samples must be chosen based on their suitability for the analyte of interest. Preservation methods and maximum holding conditions are method-specific and must be adhered to as described in Table A1 (Appendix A).

#### 4.11.1 Sample Containers

Most containers should be glass jars with Teflon-lined lids. Sample jars and lids of the acceptable type, material, and size are shown in Table A1 (Appendix A). Use of sample containers must conform to these specifications. Table A1 also contains preservation methods and maximum holding times for each analyte of interest.

All sample containers must be inspected before transit to the site to ensure they have undamaged lids and are tightly sealed. Jars must be placed into containers which are secured to prevent damage or tampering in transit to the site. Containers and lids must be re-inspected at the job site; containers that have lost lids or that have been damaged may not be used for sample containment.

#### 4.11.2 Labeling Sample Containers

All samples will be labeled immediately after collection using indelible, waterproof ink. At a

minimum, each sample will be labeled with the following information:

- (1) Unique identifying number assigned to the sample for laboratory analysis;
- (2) Date and time of collection;
- (3) Name of person collecting the sample;
- (4) Each intended laboratory analysis for the sample; and
- (5) Preservation method.

An example of a sample numbering system is included in Appendix B. All labeling information will also be recorded in the field logbook.

#### 4.11.3 Holding Times, Conditions, and Methods of Preservation

Sample handling, transport, and analysis must be arranged so that the holding times and conditions shown in Table A1 (Appendix A) are met. Also, volatile compounds must be extracted and analyzed as quickly as practical after collection. Appropriate acidic preservation of samples must be provided if required in Table A1.

## SECTION 5. SAMPLE TRANSFER

### 5.1 Chain of Custody

A completed chain of custody (COC) form is required for each sample collected, including all associated field quality control (QC) samples. A chain of custody consists of a document or label that physically accompanies each sample bottle and sample, or each batch of bottles and samples, and that provides for the name of each person assigned control of the sample and the period covered by each person's assignment. Sufficient space must be provided on the form to accommodate several different control persons and the name of their respective organization or agency.

The laboratory receiving samples must process the samples using COC procedures documented in its approved Quality Assurance (QA) Manual and Standard Operating Procedures. This section does not apply to internal laboratory procedures.

COC procedures document the handling of each sample from the time it is collected until it is destroyed. The COC record is initiated with the collection of the sample.

The COC remains with the sample at all times and bears the name of the sampler or other person assuming responsibility for the samples. The sampler is responsible for ensuring secure and appropriate handling of samples and bottles. As few people as possible should handle the sample during the investigation. A sample is considered to be under custody if one or more of the following criteria are met:

- (1) The sample is in the sampler's possession;
- (2) The sample is in the sampler's view after being in possession;
- (3) The sample was in the sampler's possession and then was locked up to prevent tampering; or
- (4) The sample is in a designated secure area.

A COC seal, which must also be used, is an adhesive seal placed in areas such that if a sealed container were opened, the seal would be broken. The COC seal ensures that no sample tampering occurred between the field and the laboratory analysis.

A COC record must accompany all sample sets. When transferring possession of samples, the individual receiving the samples should sign, date, and note the time of transfer on the COC. Samples must be properly packaged for shipment and delivered or shipped to the designated laboratory for analysis. Shipping containers must be secured by using nylon strapping tape and custody seals. The custody seals must be placed on the container so that it cannot be opened without breaking the seal. The seal must be signed and dated by the sampler. All samples

must be accompanied by the COC inside the shipping container.

Samples will be shipped to the analytical laboratory with sufficient time allowed for the laboratory to extract and analyze the samples within the holding time requirements of the analytical method. Samples will be shipped to the laboratory using an overnight carrier or hand delivered for the fastest delivery possible. Upon receipt of the samples, the laboratory will immediately notify the assessment firm if conditions or problems are identified which require immediate resolution.

Samples will be packed and shipped according to the following specifications:

- (1) Only waterproof plastic coolers will be used to ship samples;
- (2) Vermiculite will be placed in the bottom of the cooler to a depth of 3 inches;
- (3) Each container will be wrapped in paper towels to cushion and absorb moisture;
- (4) The containers will then be sealed in plastic bags labeled with the sample number, test method requested, and placed upright in the cooler so that they will not touch during shipment;
- (5) Additional inert packing material will be added to partially cover sample bottles (more than halfway). Break-proof artificial ice packs will be inserted around, among, and on top of the sample bottles. Sample temperature will be maintained at  $4^{\circ} \pm 2^{\circ} \text{C}$ ;
- (6) Paperwork (chain of custody record, appropriate field notes, and return address labels for the coolers) will be placed in a waterproof plastic bag and taped to the inside of the cooler;
- (7) The drain will be taped shut. The lid of the cooler will be secured with tape. The cooler will be wrapped with strapping tape at a minimum of two locations, without obscuring any labels;
- (8) The completed shipping label will be affixed to the top of the cooler; and
- (9) Dated and signed custody seals will be adhered to front right and back left of cooler.

## SECTION 6. ANALYTICAL PROCEDURES

### 6.1 Field-screening Procedures

Use of field-screening analyses must follow the relevant procedures outlined in Sections 4 and 7 (Calibration and Maintenance of Field Equipment) of this QAPP. Other instruments such as immunoassay test kits include the manufacturer's instructions that must be followed to create valid data.

### 6.2 Analytical Procedures

The analytical methods selected for this project are described in USEPA SW-846 methods (USEPA, 1986 and its updates for analysis of volatile organic compounds, semi volatile organic compounds, organochlorine insecticides, chlorinated herbicides, PCBs, metals and other miscellaneous analytes) and Alaska Department of Environmental Conservation (ADEC) methods AK101, AK102 and AK103 (ADEC, 1998), except as described in Table A1 (Appendix A). Proposed numbers of environmental and QC samples to be collected/analyzed per method per matrix will be provided in project specific planning documents.

Analytical services must be performed by Corps of Engineers validated and ADEC certified laboratories. Laboratory organization, responsibilities, and operations are described in the laboratory's Quality Assurance Plan (QAP). A copy of the laboratory's QAP is available for review from the laboratory upon request.

### 6.3 Determination of Analyses for Petroleum Hydrocarbons

The soil cleanup standards for petroleum in the MIC regulations are based on gas chromatographic analytical measurements corresponding to a specific measured range of petroleum hydrocarbons as follows:

- (1) Gasoline-range organic compounds (AK101): light-range petroleum products such as gasoline, with petroleum hydrocarbon compounds corresponding to an alkane range from the beginning of n-hexane ( $C_6$ ) to the beginning of n-decane ( $C_{10}$ ) and with a boiling point range between approximately 60 - 170 °C;
- (2) Diesel-range organic compounds (AK102): mid-range petroleum products such as diesel fuel, with petroleum hydrocarbon compounds corresponding to an alkane range from the beginning of n-decane ( $C_{10}$ ) to the beginning of n-pentacosane ( $C_{25}$ ) and with a boiling point range between approximately 170 - 400 °C; and

- (3) Residual-range organic compounds (AK103): heavy-range petroleum products such as lubricating oils, with petroleum hydrocarbon compounds corresponding to an alkane range from the beginning of n-pentacosane (C<sub>25</sub>) to the beginning of n-hextriacontane (C<sub>36</sub>) and with a boiling point range between approximately 400 - 550 °C.

If it can be documented that only one type of product was stored or distributed during the operational life of a facility, analytical requirements shall reflect this knowledge. If the product type is unknown, the samples must be analyzed for all types of petroleum. The information collected in the examination of the site background (Section 4.3) will be used to determine which analyses should be performed on the samples. If leaded gasoline is a potential contaminant at the site, laboratory analysis for lead must be included.

## 6.4 Hazardous Waste Determination

Analytical testing of wastes for hazardous waste determinations will be conducted using EPA's *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 upon extraction of solid wastes by the Toxicity Characteristic Leaching Procedure (TCLP), EPA Method 1311. Liquid wastes will be analyzed as liquids without the extraction procedure. Maximum concentrations of contaminants for each analytes are listed in 40 CFR 261.24, Table1.

## 6.5 Asbestos Analysis

Samples requiring analysis for asbestos content will be analyzed by an analytical laboratory accredited by the Department of Commerce, National Institute of Standards and Technology, or laboratories with interim accreditation from EPA. Analysis will be by polarized light microscopy (PLM) following methods detailed in 40 CFR 763 for solid bulk samples. Water samples will be analyzed by the method included in EPA Method 600/4-83-043.

## SECTION 7. CALIBRATION AND MAINTENANCE OF FIELD EQUIPMENT

Calibration and proper maintenance of field instruments is critical to obtaining acceptable data. Improper calibration or failure of an instrument in the field might result in improper choice of sample locations, failure to detect contamination, and inefficient and inadequate segregation of clean soils from contaminated soils and, thus, potentially much higher disposal or treatment costs.

To ensure the field instruments will be properly calibrated and remain operable in the field, the procedures set out in this section must be used for PIDs and FIDs. All other instrument calibration and maintenance must involve following the manufacturer's recommendations.

### 7.1 Calibration

- (1) If PID and FID field instruments are used, instruments must be calibrated at least daily, or before each testing session to yield "total organic vapors" in parts per million to a benzene equivalent. The PID instrument must be operated with a lamp source that is able to detect the contaminants of concern, operates at a minimum of 10.6 eV, and is capable of ionizing those contaminants of concern.
- (2) Field instruments must be calibrated on site.
- (3) All standards used to calibrate field instruments must meet the minimum requirements for source and purity recommended in the equipment's operation manual.
- (4) If the instrument's operation manual recommends specific calibration requirements for other criteria in calibrating the instrument (such as pH, conductivity, temperature, etc.), those criteria must be adhered to.
- (5) Acceptance criteria for calibration must be determined depending on the potential contaminant(s) and must be within the limits set in the manufacturer's operations manual.
- (6) The dates, times, and results of all calibrations and repairs to field instruments must be recorded in the field record and in the instrument's log.
- (7) All users of the instrument must be trained in the proper calibration and operation of the instrument and must be required to read the operation manual before initial use.

## 7.2 Maintenance

- (1) At a minimum, operation, maintenance, and calibration must be performed in accordance with the instrument manufacturer's specifications.
- (2) All users of the instrument must be trained in routine maintenance, including battery and lamp replacement, lamp and sensor cleaning, and battery charging.
- (3) Each instrument's operation and maintenance manual must be present at the site.
- (4) Field instruments must be inspected before departure to the site and on site.
- (5) Instrument battery charge must be inspected far enough ahead of time to bring the instrument up to full charge before departure to the site.
- (6) A source of extra batteries and lamps (if applicable) must be readily available.

## SECTION 8. DATA REVIEW, VALIDATION, AND REPORTING

### 8.1 Data Reduction and Review

To assure the validity of the reported data all analytical data generated by the laboratory shall be extensively reviewed prior to generation of the final data package. This internal process shall consist of data generation, reduction, and a minimum of three levels of documented review (technical, supervisory, and administrative). In each stage, the review process shall be documented using a checklist that is signed and dated by the reviewer. The analyst who generates the data shall perform the technical review and has the primary responsibility for the accuracy and completeness of the data. The purpose of the supervisory review is to provide an independent review of the data. The administrative review is performed by the quality assurance officer and is similar to the supervisory review except with the addition of a contractual compliance review. Each step of the review process involves evaluating the data quality based on the results of the QC data and the professional judgment of the reviewer. All data generated and reduced shall follow documented laboratory protocols.

#### 8.1.1 Data Deliverables

The laboratory must provide a contract laboratory program (CLP)-like data package suitable for validation as described in Section 8.2 and consistent with current EPA Contract Laboratory Program documentation (CLP forms not required). The data package must include a (1) case narrative, (2) analytical data package, (3) completed chain-of-custody forms, and (4) an electronic data deliverable in accordance with the Corps of Engineers COELT manual for generation of the EDD 1.2a diskette deliverable. The case narrative must include a complete description of any difficulties encountered during sample handling and analysis as well as the following information at a minimum:

- (1) Numbers of samples and respective matrices;
- (2) Laboratory analyses performed;
- (3) Laboratory batch number;
- (4) Condition of samples as received;
- (5) Deviations from intended laboratory/method procedures;
- (6) QC procedures used and references to the QC acceptance criteria;
- (7) Discussion of whether or not sample-holding times were met;
- (8) Discussion of laboratory QC checks that failed to meet acceptance criteria, corrective actions taken, and effectiveness of corrective actions; and
- (9) Discussion of technical problems.

The analytical data package must include the following data and summary forms at a minimum:

- (1) Cross reference of laboratory sample to project sample identification numbers;
- (2) Summary page indicating dates of analyses for environmental and QC samples;
- (3) Sample preparation and analysis methods;
- (4) Sample and QC results;
- (5) Description of data qualifiers/flags;
- (6) Raw data for sample and QC results; and
- (7) Results of initial and continuing calibration checks and GC/MS tuning results.

The laboratory must retain the data package and all supporting documentation for at least ten years after data submission.

## 8.2 Data Validation

Samples collected and analyzed in accordance with this QAPP are considered valid unless otherwise indicated. Samples that are not collected and analyzed in accordance with this QAPP will be considered invalid and will be appropriately qualified during the data validation process. Data validation will be based on USACE guidance described in *Engineer Manual EM 200-1-6, Chemical Quality Assurance For HTRW Projects* (<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em200-1-6/toc.htm>), *US EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (<http://www.epa.gov/superfund/programs/clp/download/fgorg.pdf>), and *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (<http://www.epa.gov/superfund/programs/clp/download/fgorg.pdf>) The procedures described in these guidance documents are designed to review each data set and identify biases inherent in the data, including assessing laboratory performance, overall precision and accuracy, representativeness, and completeness. Data qualifiers described in these documents will be applied to those samples that do not meet defined QC acceptance criteria. At a minimum, the following will be assessed as part of the data validation process:

- (1) Data completeness;
- (2) Holding times;
- (3) Field and Laboratory blanks;
- (4) Initial and continuing calibration;
- (5) QC reference and internal standards;
- (6) Laboratory control samples;
- (7) MS/MSDs;
- (8) Surrogates; and
- (9) Field and laboratory duplicates.

Data validation will be performed on all analytical data generated. In addition to the above validation areas, a manual comparison of the hardcopy report to the Electronic Data Deliverable (EDD) will be made.

### 8.3 Reporting Limits

Appendix A, Table A1 contains information on analytical methods, container selection, preservatives and holding times for analytes associated with the Annette Island restoration project. Reporting levels identified in Table A1 were developed by polling analytical laboratories for the best available EPA approved analytical technologies and techniques for methods listed in the table. The reporting levels in Table A1 are based upon laboratory prepared samples, free of soil humidity and matrix or other interferences. Reporting limits for actual Annette Island samples may be higher due to matrix interference, high moisture content, and low sample densities.

Appendix A, table A1 shall be adhered to as identified in Section 4.11 and 6.2.

### 8.4 Chemical Data Quality Assessment Reports (CDQAR)

Each agency is responsible for evaluation of chemical data quality, including determining contract compliance, data use ability and data quality objective attainment. The data evaluation is documented in the CDQAR by the project chemist. The CDQAR may be incorporated into the final report and need not be a separate report. CDQARs must, at a minimum, contain the following:

- (1) The laboratory's data summary as required by Section 8.1;
- (2) An interpretation of sample collection and analysis results, as required by Section 8.2;
- (3) A table that compares the required field quality control data with the acceptance criteria;
- (4) A case narrative for the project;
- (5) A discussion of any deviations from this QAPP for any sampling/analytical procedures;
- (6) A discussion of all corrective actions taken as required for any deviations from this QAPP for any sampling or analytical methods and procedures;
- (7) Restrictions on use of the data;
- (8) Statement of contract compliance or noncompliance, data adequacy; and
- (9) Lessons learned.

## 8.5 Addendum to the QAPP

The addendum to the QAPP contains tables including cleanup standards and guidance from the United States Environmental Protection Agency (USEPA, EPA), the State of Alaska Department of Environmental Conservation (ADEC) and the Metlakatla Indian Community (MIC). Also included is guidance on sediment analysis and management from the State of Washington Department of Ecology.

Addendum Table 1 provides a cross-reference of ADEC, EPA and the MIC cleanup levels, highlighting the most conservative of the three cleanup numbers. Addendum Table 2 is limited to the most stringent soil cleanup number, while Addendum Table 3 is the most stringent groundwater cleanup number. Addendum Table 4 is comprised solely of Washington State DOE sediment analytical and sediment management numbers.

These tables have been included for use as a reference to compare laboratory data against in selecting remedial alternatives options and determine extent of potential remedial actions. The levels in these tables have not been adopted, in any fashion, by the agencies participating in the Annette Island Restoration Project.

These tables are NOT to be viewed as data quality objectives (DQO), reporting limits or required minimum detection limits. Minimum detection limits and reporting limits have been included in Table A1 of Appendix A.

## SECTION 9. INTERNAL QUALITY CONTROL CHECKS

Required quality control (QC) checks include field QC check samples and laboratory QC samples. Comparison of acceptable tolerances and actually derived values for each required QC element must appear in each project report submitted, as discussed in Section 8.3.1.

### 9.1 Field Quality Control Checks

This section defines the types of field QC checks that must be used and the circumstances in which each type is to be used. All field QC check samples must be analyzed, the results of the analysis used to calculate data quality indicators, and must be summarized as shown below. When used, QC measures must be performed for the most volatile analyte under investigation.

Example of Field Quality Control Summary		
Quality Control Designation	Tolerance	Results This Project
Holding time w/methanol GRO for soil	28 days	
Holding time GRO for water	14 days at 4°+/-2° C	
Holding time to extract DRO for soil	14 days at 4°+/-2° C	
Holding time to extract DRO for water	7 days at 4°+/-2° C	
Holding time to analyze DRO for soil	Less than 40 days	
Holding time to analyze DRO for water	Less than 40 days	
Holding time to extract RRO for soil	14 days at 4°+/-2° C	
Holding time to analyze RRO for soil	Less than 40 days	
Holding time to analyze; BTEX; soil	14 days at 4°+/-2° C or per method requirements	
Holding time BTEX for water	14 days at 4°+/-2° C	
Holding time to extract PAH for soil	14 days at 4°+/-2° C	
Holding time to extract PAH for water	7 days at 4°+/-2° C	
Holding time to analyze PAH for soil	Less than 40 days	
Holding time to analyze PAH for water	Less than 40 days	
Holding time Total VCS for soil	14 days at 4°+/-2° C	
Holding time Total VCS for water	14 days at 4°+/-2° C	
Holding time to extract PCB for soil	14 days at 4°+/-2° C	
Holding time to extract PCB for water	7 days at 4°+/-2° C	
Holding time to analyze PCB for soil	Less than 40 days	
Holding time to analyze PCB for water		
Holding time on digestate	6 months	
Total metals (except Hg) for soil		
Holding time on digestate	6 months	
Total metals (except Hg) for water		
Holding time on digestate	28 days	
Mercury for soil		
Holding time on digestate for water	28 days	
Mercury for water		

Completeness	85%	
Field Duplicate	From project manager	
Decontamination Blank (s)	Less than practical quantitation limit	
Trip Blank (s)	Less than practical quantitation limit	
Methanol Trip Blank	Less than practical quantitation limit	
Field Blank	Less than practical quantitation limit	
Background Sample (s)	Assess background influence on final verification samples	
<b>Legend:</b> BTEX = Benzene, Toluene, Ethyl-benzene, or Xylene; DRO = Diesel Range Organics; GRO = Gasoline Range Organics; RRO= Residual Range Organics; PAH = Polynuclear Aromatic Hydrocarbons; individual indicator PAH compounds; PCB = Polychlorinated Biphenyls; VCS = Volatile Chlorinated Solvents.		

### 9.1.1 Minimum Field QC Sample Requirements

The minimum level of sample QC scrutiny that must be applied to field sampling is described below. A description of each type of field QC sample appears in Sections 9.1.2 to 9.1.5. Reference to sets of samples in this and subsequent subsections refers to samples taken from the same site (or, for multiple sampling points within a single project, from the same area within a site that has uniform characteristics such as grain size and organic content) during the same sampling event during a discrete time period. It does not apply to sampling points from different sites, samples collected at significant time differences from each other, or multiple samples from the same site, but with non-uniform site characteristics.

Minimum Quality Control Scrutiny		
Minimum Field QC Samples Required	When Required	Allowable Tolerance
Field Duplicate (one per set of 10 samples, minimum of one)	All soil and water samples	Precision set by Project Manager
Decontamination or Equipment Blank (one per set of 10 similar samples, minimum of one)	All soil and water samples where sampling equipment is decontaminated between samples	Less than the practical quantitation limit

Trip Blank (one per set of 10 volatile samples, minimum of one)	All water samples being analyzed for GRO, BTEX, or volatiles	Less than the practical quantitation limit
Methanol Trip Blank (one per set of 10, minimum of one)	All soil samples being analyzed for GRO, BTEX or volatiles using AK101 field methanol preservation	Less than the practical quantitation limit
Field Blank (one per set of 10, minimum of one)	Per project specifications. Used for highly contaminated sites with volatile organic contaminants	Less than the practical quantitation limit

### 9.1.2 Field Duplicate Sample

Field duplicate samples document the precision (variability) of the sampling process around the site. They are independent samples collected as close as possible to the same point in space and time. They are two separate samples collected from the same source, stored in separate containers, and analyzed independently.

At least one field duplicate must be collected for every 10 samples for each matrix sampled, for each target compound. Duplicate water samples must be collected as close as possible to the same point in space and time and must be collected before any decontamination blanks are collected. Duplicate soil samples must be collected as close as possible to the same point in space and time. All field duplicates must be blind samples and must be given unique sample numbers just like any other field sample. Their collection should be adequately documented. The results from field duplicate samples must be used to calculate a precision value for field sampling quality control.

### 9.1.3 Decontamination or Equipment Blank

A decontamination or equipment blank is used to determine if contamination occurred from sampling equipment such as pumps and bailers and checks to make sure equipment decontamination procedures have been effective. This blank is a sample of contaminant-free media used to rinse sampling equipment. It must be collected after completion of decontamination procedures and before sampling. Decontamination blanks are not required if disposable bailers are used for each sample taken.

If decontamination blanks are required, at least one decontamination blank must be collected and analyzed for each set of water samples that might contain volatiles. In addition, at least one decontamination blank must be collected and analyzed for every 10 soil samples collected each day.

#### 9.1.4 Trip Blank and Methanol Trip Blank

A trip blank is used to document if contamination occurred in the sample containers during shipping, transport, or storage procedures. This blank is a sample of contaminant-free media taken from the laboratory to the sampling site along with each batch of samples and returned to the laboratory unopened. An aqueous trip blank would contain organic-free water and a methanol trip blank would contain methanol. This type of blank can be especially useful in documenting when trace volatile organic compounds are being investigated. A trip blank would be used for samples being analyzed for all volatile organic compounds such as GRO, BTEX, and other volatile compounds.

If a trip or methanol trip blank is required, at least one trip or methanol trip blank must accompany each set of 10 samples that might contain volatile organic contaminants.

#### 9.1.5 Field Blank

A field blank is used to document if sample contamination occurred as a result of reagent and/or environmental contamination from contaminated air at the sample location. This blank is especially helpful for highly contaminated sites with volatile organic compounds. A field blank is a sample of contaminant-free media taken from the laboratory to the sampling site and opened on site during sampling activities. The field blank is then sealed and appropriately labeled and returned to the laboratory for analysis with the sample batch. The field blank does not replace the trip blank. If required, a field blank must accompany each set of 10 samples destined for volatile organic compound analysis.

#### 9.1.6 Background Sample

A background sample shall be collected to document and assess contaminant baseline or historical information. This sample is collected in an area judged to be free of all site contaminants. At least one background soil sample shall be collected for every 10 soil samples collected. All background samples shall be analyzed for contaminants known or suspected to be present at the site being sampled, and for total organic carbon (TOC) content. The sample chromatographs shall be reviewed by an experienced chemist to identify that portion of the analytical result that may be termed "biogenic interference."

## 9.2 Laboratory Quality Control Samples

Laboratory quality control (QC) samples typically accompany the field samples during the laboratory preparation and analysis. The number of laboratory QC samples depends on the standard operating procedures of the method used. Labs generally do not charge for quality control analyses. The only laboratory quality control that would affect field sampling procedures is an added surrogate(s), included in the methanol preservation solution for use on soil samples being analyzed for volatile organic contaminants, especially, GRO and BTEX using AK101. A discussion of common laboratory QC samples follows below.

### 9.2.1 List of Common Laboratory Quality Control Samples

**Surrogates;** The surrogate is analyzed and the recovery, expressed as a percentage, is intended to indicate the percent recovery of the contaminant. A surrogate is added to every sample that is being analyzed for organic compounds, including field quality control samples before sample preparation and analysis. In AK101, a methanol/surrogate solution is used in the field for preserving soil samples being analyzed for volatile organic compounds, especially GRO and BTEX.

**Retention time standard;** A retention time standard is method-specific and is used to verify the integration range. It also provides data for column performance. The elution pattern indicates expected boiling ranges for petroleum products that have boiling range production criteria.

**Laboratory control and laboratory control duplicate samples;** These samples are used to determine precision and accuracy of the analytical results through the percent recovery and relative percent difference. Quantities of stock solutions of the target contaminant(s) are added to laboratory matrix before it is extracted/digested and analyzed.

**Matrix spike and matrix spike duplicate samples;** These samples are used to assess and document the precision and bias of a method as a result of that specific sample matrix.

**Reagent blank;** The reagent blank is used to evaluate possible contamination of the analytical process by target contaminants. No contaminant should be present in the reagent blank at a concentration greater than the method detection limit.

**Bottle blanks;** Bottle blanks may be used for diesel and gasoline organic analyses to determine if the bottles used are contaminant free.

**Instrument blanks;** Instrument blanks are used for diesel and gasoline analyses to determine if the instruments used are contaminant free.

### 9.3 Performance and System Audits

The Corps of Engineers HTRW Center of Expertise (CX) will validate laboratories supporting the TERC contract every 18 months. This audit is part of the process used by the USACE to approve laboratories. Only laboratories that receive approval during this validation process will support the TERC projects. Non-approved laboratories may request USACE HTRW validation by contacting the USACE, Alaska. In addition to USACE validation, all laboratories will be approved under the ADEC UST program.

The project chemist may conduct performance and system audits for sampling and analysis. Audits may include a review of field and laboratory QA systems and an on site review of sampling, calibration, and measurement equipment. Audits may evaluate the capability and performance of project personnel, items, activities, and documentation. The audits will ensure and document that QC measures are being used to provide data of acceptable quality and that subsequent calculations, interpretations, and other project output are checked and validated. The project chemist may conduct scheduled and unscheduled audits. The project chemist will audit fieldwork and review the project documentation.

The entire QA process is evaluated during a system audit. The project or field team organization is reviewed for compliance with the proposed organization and clarity of assigned responsibility. Qualifications of personnel assigned to the project will be reviewed to make certain that assigned responsibility, skill, and training are properly matched.

A system audit may be conducted on all components of a measurement system to determine proper selection and use. The system audit includes evaluation of both field and laboratory procedures.

During a performance audit, proper execution of SOPs or QC procedures is evaluated. The audit will address whether field equipment and analytical instruments are selected and used to meet requirements specified by the stated project objectives. Equipment and facilities provided for personnel health and safety may also be evaluated. Calibration procedures for field instruments will also be audited.

A review of analytical methodology with respect to data requirements for the project will be performed. An on site observation of analytical techniques, data reduction, and record keeping will be performed, if an audit is conducted. QA audits are conducted at the request of project management or the USAED. A written report of a QA project audit will include the following:

- (1) An assessment of project team status in each major project area
- (2) Clear statements of areas requiring improvement or problems to be corrected
- (3) Recommendations and assistance regarding proposed corrective action or system improvements
- (4) A timetable for any corrective action required

The assessment firm's project chemist will be responsible for coordinating audits and audit records disposition.

## SECTION 10. CORRECTIVE ACTIONS

Corrective actions are procedures and actions taken to correct unacceptable or unexpected deviations in sampling or analysis. An example is re-analyzing one or more affected samples or reporting questionable data with a note of explanation on the situation. Ultimate responsibility for corrective actions rests with the assessment firm. While appropriate corrective actions for out-of-control situations in the laboratory must be addressed by laboratory QA/QC documents, the customer (USACE, FAA or other contracting federal agency) is responsible for ensuring the assessment firm shows that all corrective actions enable the data quality objectives to be met.

### 10.1 Handling Invalid Samples

If an invalid sample is collected, the following procedures must be followed:

- (1) If the completeness objective for the project is met and observations and field-screening do not indicate the invalid sample was collected at a location with higher than the average contamination levels at the site, an explanatory note of the deviation from this chapter must accompany the report and no further corrective action for deviation is required; and
- (2) If the completeness objective for samples at the site is not met or observations and field-screening indicate the invalid sample was collected at a location with higher than the average contamination levels at the site, sample(s) must be recollected at the proper location on the site, properly analyzed and reported, and an explanatory note of the deviation from this chapter must accompany the data report.

### 10.2 Field Instrument Failure and Improper Use

If field instruments are being improperly used (or are not used), field data must be recollected utilizing field screening procedures as specified in Section 4.

### 10.3 Failures in Data Processing, Management, or Analysis

Problems with data processing, management, or analysis are typically discovered during data reduction, validation, and reporting (see Section 8). If these problems occur, the data user shall ensure the QA officer or another appropriate person is notified. Upon review of the problem, the data user shall ensure the QA officer or other appropriate person initiates actions to correct the improper procedure; and adheres to procedures outlined for notifying the QA officer and project manager of potential data quality problems.

## 10.4 Corrective Actions with Laboratory

Normally, any corrective actions necessary in a laboratory are handled internally by the approved laboratory through its approved QA/QC procedures on file with Corps of Engineers. The need for corrective action in the laboratory is identified by:

- (1) The laboratory's internal QC checks;
- (2) The data review conducted by the assessment firm (see Section 8.3); or
- (3) The laboratory's performance audits.

## SECTION 11. SURVEYING

Of primary importance during investigation of a contaminated site, is the ability to identify where and at what depth samples were collected. Historically, sampling locations have been based upon swing-tie measurements taken from corners of structures, foundations or other physical contours. As environmental restoration activities at Annette Island progress many of the structures these measurements are based upon will be demolished or removed, greatly impacting the ability to use data documented with these methods. This may necessitate re-sampling some locations to re-define/delineate the area of contamination.

In the course of surveying sampling site locations, soil borings and other features required for projects, other existing improvements such as building corners, runway features and storage tanks should be surveyed to provide a geographical reference between current survey efforts and the existing map.

All surveying shall be conducted as follows:

### 11.1 General

Survey services to be provided may consist of, but are not limited to, the following: establishing the x, y and z coordinates for monitoring wells, sample locations, test pits, excavations, structures and topographic mapping. Specific survey services shall be described in individual task orders. Surveys completed as part of services described in individual task orders (scope of work) shall be performed by or under the direct supervision of a professional land surveyor licensed within the State of Alaska. Unless otherwise specified, all surveying shall be done using North American Datum from 1983 (NAD 83), Alaska State Planar, Zone 1.

#### 11.1.1 Survey Deliverables

Upon completion of all fieldwork, the Contractor shall prepare mylars of the area as surveyed (if required in the scope of work/task order). The drawings provided shall show all survey control as recovered or set, all elevations and features as obtained. All survey data shall be provided on CD in files accessible through and for use within AutoCAD Release 14 and/or AutoCAD 2000. All original field notes, sketches, recordings, and computations made by the Contractor or Subcontractor in establishing the survey shall become the property of the Government upon completion of the contract.

## 11.2 Survey Control

All horizontal and vertical control shall originate from and end on existing information as provided by the Alaska District, Corps of Engineers. Grid systems to be used when performing surveys shall follow those existing at the site. If there is no existing system, the grid system to be used will be specifically identified in the individual task order.

## 11.3 Monuments

All efforts shall be made to protect established survey monuments from accidental removal caused by earth movement activities and operating heavy equipment near the monuments. Should monuments be required to be established due to disturbance, destroyed within site cleanup area or lack of control monuments at the site, procedures for installations shall follow guidelines described in EM 110-1-1002 *Survey Markers and Monumentation*, <http://www.usace.army.mil/inet/usace-docs/eng-manuals/em110-1-1002/toc.htm>. New monuments shall be established outside of proposed cleanup areas.

## 11.4 Survey Procedures and Specifications

The use of Global Positioning System (GPS) shall follow guidelines delineated in EM 1110-1-1003, *NavStar Global Positioning System Surveying*. The use of conventional survey systems (total station, etc.) shall follow procedural guidance and specifications in EM 1110-1-1005, *Topographic Surveying*.

The EMs referenced above are available on the internet at the following address:  
<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-1-1005/toc.htm>

## 11.5 Accuracy Standards

The survey shall conform to the Third Order Class 1 requirements for establishing new primary control as specified in EM 1110-1-1005, *Topographic Surveying*. Secondary control for the location of the items in Paragraph 11.1.1 shall also conform to EM 1110-1-1005.

## 11.6 Swing-Tie Measurements

Swing-Tie Measurements shall not be used due to ongoing demolition activities that may remove supposed permanent structures.

## SECTION 12. INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) is liquid or solid materials, including sampling equipment and personnel protective equipment (PPE), derived from or contaminated while conducting sampling of contaminated sites. Waste shall be managed and disposed of in accordance with Waste Management Plans developed as part of each Work Plan, as required by Metlakatla Indian Community Guidelines for Cleanup and Remediation of Open Dumps and Other Contaminated Sites, Section 7.2. At a minimum Waste Management Plans shall meet tribal, state (18 AAC 60.20 and 18 AAC 62) and federal requirements (40 CFR 261, 262, 263 and 268).

## SECTION 13. REFERENCES

SW-846 On-Line, <http://www.epa.gov/epaoswer/hazwaste/test/main.htm>

40 CFR Part 761 June 24, 1998 Technical and Procedural Amendments to TSCA Regulations—Disposal of Polychlorinated Biphenyls (PCBs) ACTION: Final rule; technical and procedural amendments.

ADEC, 1998, Underground Storage Tanks Procedures Manual: Guidance for Treatment of Petroleum Contaminated Soil and Water and Standard Sampling Procedures.

USACE, 1994, Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3. <http://www.usace.army.mil/inet/usace-docs/eng-manuals/em200-1-3/a-b.pdf>

USACE, 1995, Technical Project Planning Guidance to HTRW Data Quality Design, EM 200-1-2. <http://www.usace.army.mil/inet/usace-docs/eng-manuals/em200-1-2/toc.htm>

USACE, 1997, Chemical Quality Assurance for HTRW Projects, EM 200-1-6. <http://www.usace.army.mil/inet/usace-docs/eng-manuals/em200-1-6/toc.htm>

(Note: Electronic copies of USACE Engineering manuals are available at: <http://www.usace.army.mil/inet/usace-docs/eng-manuals/>

Code of Federal Regulations, 1998, 40 CFR 136, Appendix B, Definition and Procedure for the Determination of the Method Detection Limit – Revision 1.11. <http://www.nara.gov/>

Code of Federal Regulations, 1998, 40 CFR 261.24, Toxicity Characteristic. <http://www.nara.gov/>

Code of Federal Regulations, 1998, 40 CFR 750 and 761, Disposal of Polychlorinated Biphenyls. <http://www.nara.gov/>

USEPA, 1983, Analytical Method for the Determination of Asbestos Fibers in Water, EPA 600/4-83-043. <http://www.epa.gov>

USEPA, 1986, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Third Edition September 1986; Final Update I, July 1992; Final Update IIA, August 1993; Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IIIA, May 1997. <http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm>

USEPA, 1994a, Contract Laboratory Program National Functional Guidelines for Organic Data

Review, EPA 540/R-94-012. <http://www.epa.gov/superfund/programs/clp/download/fgorg.pdf>

USEPA, 1994b, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-94-013. <http://www.epa.gov/superfund/programs/clp/download/fginorg.pdf>

USEPA, 1996, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, EPA 540/S95/504. <http://www.epa.gov>

USEPA, 1996, How To Effectively Recover Free Product at Leaking Underground Storage Tank Sites, EPA 510-R-96-101 [http://www.epa.gov/swerust1/pubs/fpr\\_c1&2.pdf](http://www.epa.gov/swerust1/pubs/fpr_c1&2.pdf)

## APPENDICES

APPENDIX A. Table A1 – REFERENCE GUIDE TO SAMPLE COLLECTION AND  
LABORATORY ANALYSIS

Table A1 - REFERENCE GUIDE TO SAMPLE COLLECTION AND LABORATORY ANALYSIS

ANALYTE	REPORTING LEVEL <sup>1</sup>		SAMPLE	PRESERVATIVE <sup>3</sup>	HOLDING TIME <sup>4</sup>
	Water (ug/L)	Soil (mg/kg)	CONTAINER <sup>2</sup>		
<b>Metals</b>	<b>6020</b>	<b>6020</b>			
Antimony	3	3			
Arsenic	1	1	Water: 500 mL glass or HDPE bottle <sup>5</sup>	Water: HNO <sub>3</sub> to pH <2,	Water and soil: 180 days until analysis
Barium	1	1		Cool to 4 °C	
Beryllium	0.5	0.5			
Cadmium	0.5	0.5			
Chromium	1	1			
Copper	1	1			
Lead	0.5	0.5	Soil: 8 ounce wide-mouth	Soil: Cool to 4 °C	
Nickel	1	1	glass jar		
Selenium	3	3			
Silver	0.5	0.5			
Thallium	0.5	0.5			
Vanadium	1	1			
Zinc	4	4			
<b>Mercury</b>	<b>7470A</b>	<b>7471A</b>	Water: 500 mL glass or HDPE bottle	Water: HNO <sub>3</sub> to pH <2,	Water and soil: 28 days until analysis
	0.0002 mg/L	0.1		Cool to 4 °C	
			Soil: 8 ounce wide-mouth		
			glass jar	Soil: Cool to 4 °C	
<b>Cyanide</b>	<b>335.3 MOD</b>	<b>335.3 MOD</b>	Water: 500 mL glass or HDPE bottle	Water: NaOH to pH >12,	Water and soil: 14 days until analysis
	0.2 mg/L	20		0. 6 g of Ascorbic acid,	
			Soil: 4 ounce wide-mouth	Cool to 4 °C	
			glass jar	Soil: Cool to 4 °C	
<b>Hardness</b>	<b>130. 1</b>	<b>NA</b>	Water: 250 mL HDPE bottle	Water: HNO <sub>3</sub> to pH <2,	Water: 180 days until analysis
	5 mg/L				
<b>Asbestos</b>	<b>EPA 600/4-83-043</b>	<b>40CFR763, Sbpt E,</b>	Water: 1L glass or HDPE bottle	None	None
	7 million long	<b>Appendix E</b>			
	fibers per liter	1 percent	Soil: 8 ounce wide-mouth glass jar		

Table A1 - REFERENCE GUIDE TO SAMPLE COLLECTION AND LABORATORY ANALYSIS

ANALYTE	REPORTING LEVEL		SAMPLE	PRESERVATIVE	HOLDING TIME
	Water (ug/L)	Soil (mg/kg)	CONTAINER		
<b>Organochlorine pesticides</b>	<b>8081A</b>	<b>8081A</b>			
4,4'-DDD	0.02	0.002			
4,4'-DDE	0.02	0.002			
4,4'-DDT	0.02	0.002	Water: Two 1L amber glass bottles with Teflon-lined caps	Water and soil: Cool to 4 °C	Water: 7 days until extraction and 40 days until analysis
Aldrin	0.01	0.001			
Chlordane, total	0.1	0.01			
Dieldrin	0.02	0.002			
Endosulfan I	0.01	0.001			
Endosulfan II	0.02	0.002			
Endosulfan sulfate	0.02	0.002			
Endrin	0.02	0.002			
Endrin aldehyde	0.02	0.002			
Endrin ketone	0.02	0.002			
Heptachlor	0.01	0.001	Soil: 8 ounce wide-mouth glass jar with Teflon-lined cap		Soil: 14 days until extraction and 40 days until analysis
Heptachlor epoxide	0.01	0.001			
Methoxychlor	0.1	0.01			
Toxaphene	1	0.1			
alpha-BHC	0.01	0.001			
beta-BHC	0.01	0.001			
delta-BHC	0.01	0.001			
gamma-BHC (Lindane)	0.01	0.001			
<b>Polychlorinated biphenyls</b>	<b>8082A</b>	<b>8082A</b>	Water: Two 1L amber glass bottles with Teflon-lined caps	Water and soil: Cool to 4 °C	Water: 7 days until extraction and 40 days until analysis
PCB-1016	0.1	0.01			
PCB-1221	0.2	0.02			
PCB-1232	0.1	0.01	Soil: 8 ounce wide-mouth glass jar with Teflon-lined cap		Soil: 14 days until extraction and 40 days until analysis
PCB-1242	0.1	0.01			
PCB-1248	0.1	0.01			
PCB-1254	0.1	0.01			

Table A1 - REFERENCE GUIDE TO SAMPLE COLLECTION AND LABORATORY ANALYSIS

ANALYTE	REPORTING	LEVEL	SAMPLE	PRESERVATIVE	HOLDING TIME
	Water (ug/L)	Soil (mg/kg)	CONTAINER		
PCB-1260	0.1	0.01			
<b>Chlorinated herbicides by GCMS-Ion Trap</b>	<b>8151A</b>	<b>8151A</b>	Water: Two 1L amber glass bottles with Teflon-lined caps	Water and soil: Cool to 4 °C	Water: 7 days until extraction and 40 days until analysis
2,4-D	0.2	0.017			
2,4-DB	0.2	0.017			
2,4,5-T	0.1	0.008	Soil: 8 ounce wide-mouth glass jar with Teflon-lined cap		Soil: 14 days until extraction and 40 days until analysis
2,4,5-TP	0.2	0.017			
Dalapon	0.2	0.017			
Dichloroprop	0.2	0.017			
Dinoseb	0.1	0.008			
MCPA	0.3	0.025			
MCP	0.2	0.017			
<b>Volatile organic compounds by GCMS-Ion Trap</b>	<b>8260B</b>	<b>8260B</b>			
1,1,1-Trichloroethane	0.4	0.0004			
1,1,2,2-Tetrachloroethane	0.4	0.0004			
1,1,2-Trichloroethane	0.4	0.0004			
1,1-Dichloroethane	0.4	0.0004			
1,1-Dichloroethene	0.4	0.0004	Water: Three 40 mL glass VOA <sup>6</sup>	Water: HCl to pH<2,	Water: 14 days
1,2-Dichlorobenzene	0.4	0.0004	vials with Teflon-lined septa	Cool to 4 °C	
1,2-Dichloroethane	0.4	0.0004			
1,2-Dichloropropane	0.4	0.0004			
1,3-Dichlorobenzene	0.4	0.0004			
cis-1,3-Dichloropropene	0.4	0.0004			
trans-1,3-Dichloropropene	0.4	0.0004			
1,4-Dichlorobenzene	0.4	0.0004			
2-Butanone (MEK)	2	0.0004			
2-Hexanone	2	0.0004			
4-Methyl-2-pentanone	2	0.0004			
1,2,4-Trimethylbenzene	0.4	0.0004			
1,3,5-Trimethylbenzene	0.4	0.0004			
Acetone	2	0.0004			

Table A1 - REFERENCE GUIDE TO SAMPLE COLLECTION AND LABORATORY ANALYSIS

ANALYTE	REPORTING	LEVEL	SAMPLE	PRESERVATIVE	HOLDING TIME
	Water (ug/L)	Soil (mg/kg)	CONTAINER		
Benzene	0.4	0.0004			
Bromodichloromethane	0.4	0.0004	Soil: Two 4 ounce amber glass	Soil: NaHSO <sub>4</sub> to pH < 2,	Soil: 14 days
Bromoform	0.4	0.0004	bottles with Teflon-lined septa; One unpreserved sample container for dry weight determination	Cool to 4 °C	
Bromomethane	0.4	0.0004			
n-Butanol	1000	40			
tert-Butyl methyl ether	2	0.08			
Carbon disulfide	0.4	0.0004			
Carbon tetrachloride	0.4	0.0004			
Chlorobdibromomethane	0.4	0.0004			
Chlorobenzene	0.4	0.0004			
Chloroethane	0.4	0.0004			
Chloroform	0.4	0.0004			
Chloromethane	0.4	0.0004			
cis-1,2-Dichloroethene	0.4	0.0004			
Ethyl benzene	0.4	0.0004			
Methylene chloride	0.4	0.0004			
Styrene	0.4	0.0004			
Tetrachloroethene	0.4	0.0004			
Toluene	0.4	0.0004			
trans-1,2-Dichloroethene	0.4	0.0004			
Trichloroethene	0.4	0.0004			
Vinyl chloride	0.4	0.0004			
Xylenes, total	1.2	0.0012			
<b>Semi volatile organic compounds by GCMS-Ion Trap</b>	<b>8270C</b>	<b>8270C</b>			
1,2-Dichlorobenzene	0.05	0.05			
1,3-Dichlorobenzene	0.05	0.05			
1,4-Dichlorobenzene	0.05	0.05			
1,2,4-Trichlorobenzene	0.05	0.05			
2,4,5-Trichlorophenol	0.05	0.05			

Table A1 - REFERENCE GUIDE TO SAMPLE COLLECTION AND LABORATORY ANALYSIS

ANALYTE	REPORTING	LEVEL	SAMPLE	PRESERVATIVE	HOLDING TIME
	Water (ug/L)	Soil (mg/kg)	CONTAINER		
2,4,6-Trichlorophenol	0.05	0.05	Water: Two 1L amber glass bottles with Teflon-lined caps	Water: Cool to 4 °C	Water: 7 days until extraction and 40 days until analysis
2,4-Dichlorophenol	0.05	0.05			
2,4-Dimethylphenol	0.05	0.05			
2,4-Dinitrophenol	0.05	0.05			
2,4-Dinitrotoluene	0.05	0.05			
2,6-Dinitrotoluene	0.05	0.05			
2-Chloronaphthalene	0.01	0.01			
2-Chlorophenol	0.05	0.05			
2-Methyl-4,6-dinitrophenol	0.05	0.05			
2-Methylnaphthalene	0.01	0.01			
2-Nitroaniline	0.05	0.05	Soil: 8 ounce wide-mouth glass jar with Teflon-lined cap	Soil: Cool to 4 °C	Soil: 14 days until extraction and 40 days until analysis
2-Nitrophenol	0.05	0.05			
3,3'-Dichlorobenzidine	0.5	0.05			
3-Nitroaniline	0.05	0.05			
4-Bromophenyl phenyl ether	0.05	0.05			
4-Chloro-3-methyl phenol	0.05	0.05			
4-Chloroaniline	0.05	0.05			
4-Chlorophenyl phenyl ether	0.05	0.05			
4-Methylphenol (p-cresol)	0.05	0.05			
4-Nitroaniline	0.05	0.05			
4-Nitrophenol	0.05	0.05			
Acenaphthene	0.01	0.01			
Acenaphthylene	0.01	0.01			
Anthracene	0.01	0.01			
Benzo(a)anthracene	0.01	0.01			
Benzo(a)pyrene	0.01	0.01			
Benzo(b)fluoranthene	0.01	0.01			
Benzo(g,h,i)perylene	0.01	0.01			
Benzo(k)fluoranthene	0.01	0.01			
Benzoic acid	0.05	0.05			

Table A1 - REFERENCE GUIDE TO SAMPLE COLLECTION AND LABORATORY ANALYSIS

ANALYTE	REPORTING	LEVEL	SAMPLE	PRESERVATIVE	HOLDING TIME
	Water (ug/L)	Soil (mg/kg)	CONTAINER		
Benzyl butyl phthalate	1	0.05			
bis-(2-chloroethoxy)methane	0.05	0.05			
bis-(2-chloroethyl)ether	0.05	0.05			
<b>Semi volatile organic compounds,</b>	<b>8270C</b>	<b>8270C</b>			
2-Methylphenol (o-cresol)	0.05	0.05			
Dibenzo (a,h) anthracene	0.01	0.01	with Teflon-lined caps		and 40 days until analysis
Dibenzofuran	0.05	0.05			until analysis
Diethyl phthalate	0.05	0.05			
Dimethyl phthalate	0.05	0.05			
Di-n-butyl phthalate	0.05	0.05			
Di-n-octyl phthalate	0.05	0.05			
Fluoranthene	0.01	0.01			
Fluorene	0.01	0.01			
Hexachlorobenzene	0.05	0.05			
Hexachlorobutadiene	0.05	0.05			
Hexachlorocyclopentadiene	0.05	0.05	Soil: 8 ounce wide-mouth glass jar with Teflon-lined cap	Soil: Cool to 4 °C	Soil: 14 days until extraction and 40 days until analysis
Hexachloroethane	0.05	0.05			
Indeno (1,2,3-cd) pyrene	0.01	0.01			
Isophorone	0.05	0.05			
Naphthalene	0.01	0.01			
Nitrobenzene	0.05	0.05			
n-Nitrosodi-n-propylamine	0.05	0.05			
n-Nitrosodiphenylamine	0.01	0.05			
Pentachlorophenol	0.05	0.05			
Phenanthrene	0.01	0.01			
Phenol	0.05	0.05			
Pyrene	0.01	0.01			
<b>Polynuclear aromatic hydrocarbons</b>	<b>8270</b>	<b>8270</b>			
<b>By GCMS - Ion Trap</b>					
Acenaphthene	0.01	0.01	Water: Two 1L amber glass bottles	Water: Cool to 4 °C	Water: 7 days until extraction

Table A1 - REFERENCE GUIDE TO SAMPLE COLLECTION AND LABORATORY ANALYSIS

ANALYTE	ANALYTE	ANALYTE	ANALYTE	ANALYTE	ANALYTE
Anthracene	0.01	0.01	with Teflon-lined caps		and 40 days until analysis
Benzo (a) anthracene	0.01	0.01			
Benzo (a) pyrene	0.01	0.01			
Benzo (b) fluoranthene	0.01	0.01			
Benzo (g,h,i) perylene	0.01	0.01			
Benzo (k) fluoranthene	0.01	0.01	Soil: 8 ounce wide-mouth glass	Soil: Cool to 4 °C	Soil: 14 days until extraction
Chrysene	0.01	0.01	jar with Teflon-lined cap		and 40 days until analysis
Dibenzo (a,h) anthracene	0.01	0.01			until analysis
Fluoranthene	0.01	0.01			
Fluorene	0.01	0.01			
Indeno (1,2,3-cd) pyrene	0.01	0.01			
Naphthalene	0.01	0.01			
Phenanthrene	0.01	0.01			
Pyrene	0.01	0.01			
<b>Gasoline-range organics (GRO)</b>	<b>AK101</b>	<b>AK101</b>	Water: Two 40 mL VOA vials with	Water: HCl to pH <2,	Water: 14 days
	50	2	Teflon-lined septa	Cool to 4 °C. Soil:	
				Surrogated	
			Soil: 4 ounce amber glass	methanol preservative,	Soil: 28 days
			jar with Teflon-lined septa	Maintain temperature	
				<25 °C	
<b>Diesel-range organics (DRO)</b>	<b>AK102</b>	<b>AK102</b>	Water: Two 1L amber glass bottles	Water: HCl to pH < 2,	Water: 7 days until extraction
	100	33	with Teflon-lined caps	Cool to 4 °C.	and 40 days until analysis
			Soil: 4 ounce amber glass jar		Soil: 14 days until extraction
			with Teflon-lined cap	Soil: Cool to 4 °C	and 40 days until analysis
<b>Residual-range organics (RRO)</b>	<b>AK103</b>	<b>AK103</b>	Water: Two 1L amber glass bottles	Water: HCl to pH <2,	Water: 7 days until extraction
	100	40	with Teflon-lined caps	Cool to 4 °C.	and 40 days until analysis
			Soil: 4 ounce amber glass jar		Soil: 14 days until extraction
			with Teflon-lined cap	Soil: Cool to 4 °C	and 40 days until analysis
<b>Ethylene dibromide</b>	<b>504. 1</b>	<b>NA</b>	Water: Three 40 mL glass VOA	Water: Cool to 4 °C	Water: 28 days
	0.02		vials with Teflon-lined septa		
<b>Aromatic volatile organic compounds</b>	<b>8021A</b>	<b>8021A</b>	Water: Three 40 mL glass VOA	Water: HCl to pH<2,	Water: 14 days
			vials with Teflon-lined septa	Cool to 4 °C	
Benzene	1	0.04			
Toluene	1	0.04			

Table A1 - REFERENCE GUIDE TO SAMPLE COLLECTION AND LABORATORY ANALYSIS

ANALYTE	ANALYTE	ANALYTE	ANALYTE	ANALYTE	ANALYTE
Ethyl benzene	1	0.04	Soil: Two 4 ounce amber glass jars	Soil: NaHSO <sub>4</sub> to pH < 2,	Soil: 14 days
Xylenes, total	3	0.12	with Teflon-lined septa	Cool to 4 °C	

## Notes to Table A1, Reference Guide to Sample Collection and Laboratory Analysis

<sup>1</sup> Analytical methods are described in the following publications:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, September 1986, and its updates.

Methods for the Chemical Analysis of Water and Wastes, March 1983, EPA 600/4-79-020.

Analytical Method for the Determination of Asbestos Fibers in Water, September 1983, EPA 600/4-83-043.

40 CFR Part 763, Asbestos.

Methods for the Determination of Organic Compounds in Drinking Water, Supplement III, August 1995, EPA 600/R-95/131.

<sup>2</sup> Clear glass bottles may be substituted for amber bottles if samples are protected from exposure to light.

<sup>3</sup> When any samples is to be shipped by common carrier or sent through the U. S. Postal Service, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR 172). The person offering such material for transportation is responsible for ensuring such compliance.

<sup>4</sup> Samples should be analyzed as soon as possible after collection. The holding times listed are the maximum times that samples may be held before extraction and/or analysis and still be considered valid.

<sup>5</sup> HPDE; High density polyethylene bottle specifically cleaned for trace metal analyses.

<sup>6</sup> VOA; Volatile organic analysis.

## APPENDIX B. SAMPLE NUMBERING SYSTEM

The first six parts of the following sample identification system will minimally identify samples. Samples requiring multiple analyses and/or multiple containers will use a single number for all containers. If the sample location is not at a facility identified in the list of facility identifiers, use the identifier for the nearest facility with an identifier. The Contractor may add additional number/letters to the end of the code. The sample identification system is shown below:

1.	FAA Station identifier	e.g. , ANN - Annette		
2.	Year (last two digits)	e.g. , 00, 01		
3.	Sample Collection Method/Location			
	Surface Sample	SL	Subsurface Sample	SS
	Sediment Sample	SD	Monitoring Well	MW
	Private Well	PW	Surface Water	SW
	Drum	DR	Wipe Sample	WP
	Trip Blank	TB	Equipment (Rinsate) Blank	EB
	Observation Well	OW	Pump Test Well	PT
	Storage Tank	ST	Transformer	TR
	Asbestos Containing Material	AS	Sump	SP
	Micro Probe	MP		
4.	Location/Well Number	001-999		
5.	Facility Identifier			
	RCAG	C	Flight Service Station	F
	Non-Directional Beacon	N	Quarters Area	Q
	Runway/Runway Aids	R	Shop/Power/Storage	S
	Tank Farm	T	VORTAC	V
	Other	M		
6.	Sample Number	01-99		
7.	Number/Letter Identifiers	Optional Identifiers for Contractor's Use		

Groundwater sample numbers are assigned sequentially by sampling round, using the same well number e.g. , MW001T01, MW001T02, MW001T03 are the numbers for the groundwater samples from the initial and two successive rounds of groundwater samples obtained from Monitoring Well Number 001 located at the Tank Farm. Duplicate samples for groundwater shall use a fictional well number.

Each sample obtained in the borehole is assigned a sequential number starting with the surface sample. This includes samples that are only screened in the field. Samples sent to the laboratory are not to be renumbered.

Trip blanks and equipments blanks do not need the final two digits. The blanks shall be numbered

sequentially for each station for each year.

Several examples of sample identification numbers are described below:

OME96SL001V01

Where:	OME	=	Nome Station
	96	=	Sample collected in 1996
	SL	=	Surface-soil sample
	001	=	Sample location number 1
	V	=	Sample location is near the VORTAC
	01	=	The first sample from that location

FAI94MW003R02

Where:	FAI	=	Fairbanks Station
94	=		Sample collected in 1994
	MW	=	Sample collected from monitoring well
	003	=	Monitoring well number 3
	R	=	The well is located near Runway-associated
facilities/equipment	02	=	The second round of sampling from MW003

FYU96SS018Q01

Where:	FYU	=	Fort Yukon Station
96	=		Sample collected in 1996
SS	=		Soil sample collected from a boring
018	=		The sample location is number 18
Q	=		The sample location is in the Quarters Area
01	=		The first sample collected from the boring,
surface			usually at the surface

The next sample taken from the boring would be FYU96SS018Q02. All samples collected from the borehole have to be labeled even if the sample is used only for field-performed analyses. Samples sent to the laboratory must maintain the original number assigned. DO NOT RENUMBER THE SAMPLES SENT TO THE LABORATORY.

## APPENDIX C. LABORATORY DATA REPORT CHECK SHEET

## LABORATORY DATA REPORT CHECK SHEET

Reviewer \_\_\_\_\_ Date \_\_\_\_\_

Project \_\_\_\_\_

1. Laboratory name \_\_\_\_\_, address \_\_\_\_\_ telephone number \_\_\_\_\_, fax number \_\_\_\_\_  
QA Officer Signature \_\_\_\_\_ date signed \_\_\_\_\_
2. Report date \_\_\_\_\_
3. Analyte of interest, or target analyte \_\_\_\_\_
4. Extraction method # \_\_\_\_\_ and name \_\_\_\_\_
5. Type of matrix \_\_\_\_\_
6. Field sample number \_\_\_\_\_
7. Lab sample number \_\_\_\_\_
8. Lab file ID number \_\_\_\_\_
9. Date sampled \_\_\_\_\_
10. Date received \_\_\_\_\_
11. Date extracted \_\_\_\_\_
12. Date analyzed \_\_\_\_\_
13. Sample collection point \_\_\_\_\_
14. Site or project name \_\_\_\_\_
15. Concentration of analyte (mg/kg dry or mg/L) \_\_\_\_\_  
% solids analysis or explanation \_\_\_\_\_  
method detection limit or method reporting limit indicated \_\_\_\_\_
16. Identification of flags or qualifiers \_\_\_\_\_  
All corrections and strikeouts initialed and dated \_\_\_\_\_
17. Precision and accuracy value for each sample set \_\_\_\_\_
18. Ambient container temperature upon receipt of sample \_\_\_\_\_  
time/date temperature measured \_\_\_\_ sample refrigerated \_\_\_\_  
temperature \_\_\_\_ date/time \_\_\_\_\_
19. Sample transfer log/release/chain-of-custody form \_\_\_\_\_
20. Analyst's name on all report pages \_\_\_\_\_ with date prepared \_\_\_\_\_  
Analyst's signature/initials on all chromatograms \_\_\_\_\_
21. Dilution factor \_\_\_\_\_
22. Case narrative summary \_\_\_\_\_
23. Report securely bound \_\_\_\_\_, with sequentially numbered pages \_\_\_\_\_  
\_\_\_\_\_

## LABORATORY DATA REPORT CHECK SHEET CONTINUED

**NOTE:** All items listed below must be kept on file for at least ten years after analysis:

1. Laboratory file identification number \_\_\_\_\_
2. Original data package (with analyst's initials)  
Sample queue \_\_\_\_ chromatograms included \_\_\_\_ chromatograms clearly labeled \_\_\_\_ chromatograms baseline-baseline integrated \_\_\_\_ integration report included (clearly labeled) \_\_\_\_ integration range clearly indicated \_\_\_\_ date/time on all chromatograms \_\_\_\_\_
3. Calibration report (with analyst's initials)  
Date/time of initial calibration \_\_\_\_ concentration range clearly indicated \_\_\_\_ composition of calibration standard(s) \_\_\_\_ Lab Control Standard analyzed, date/time \_\_\_\_  
Continuing Calibration Standard analyzed, date/time \_\_\_\_
4. Surrogate used \_\_\_\_ surrogate properly identified \_\_\_\_  
% recovery for each sample \_\_\_\_ acceptable range indicated \_\_\_\_ outliers explained \_\_\_\_
5. Alkane/window retention time standard analyzed \_\_\_\_  
components properly identified \_\_\_\_\_
6. Column performance/separation number \_\_\_\_ Date determined \_\_\_\_ analyst's initials \_\_\_\_
7. Spike/spike duplicate analyzed \_\_\_\_ recoveries \_\_\_\_ relative % difference \_\_\_\_ acceptable range clearly indicated \_\_\_\_ outliers explained \_\_\_\_
8. Blank data (no blank correction of field samples!) Reagent blank \_\_\_\_\_, Method blank \_\_\_\_\_, Bottle blank \_\_\_\_\_
9. **Optional.** Reference (library) sample included \_\_\_\_ Pattern match/narrative summary \_\_\_\_\_

## ADDENDUM TABLES 1 THRU 4

### Disclaimer

This addendum to the QAPP contains tables including cleanup standards and guidance from the United States Environmental Protection Agency (USEPA, EPA), the State of Alaska Department of Environmental Conservation (ADEC) and the Metlakatla Indian Community (MIC). Also included is guidance on sediment analysis and management from the State of Washington Department of Ecology.

These tables have been included for use as a reference to compare laboratory data against in selection of remedial alternatives options and determine possible extent of potential remedial actions. The levels in these tables have not been adopted, in any fashion, by the agencies participating in the Annette Island Restoration Project.

These tables are NOT to be viewed as data quality objectives (DQO), reporting limits or required minimum detection limits. Minimum reporting limits have been included in table A1 of Appendix A.

# ADDENDUM TABLE 1

					Metlakatla Indian		EPA		
	ADEC - TABLE B1. METHOD TWO -				Community		Region 9		
	SOIL CLEANUP LEVELS TABLE				Soil Cleanup		PRGs		
					Levels				
	Over 40 inch Zone <sup>3</sup>								
CHEMICAL NAME	Ingestion	Inhalation	Migration to		Residential	Industrial	Residential	Industrial	Reporting
(Carcinogens in Bold Type)	(mg/kg)	(mg/kg)	Groundwater		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	Limit
			(mg/kg)						(mg/kg)
ORGANICS									
Asbestos					<1%	<1%			
Acenaphthene <sup>15</sup>	5000		190		190	2000			
Acetone (2-Propanone)	8300		9		9	8000	1600	6200	
Aldrin	0.4	18	1.5		0.03	0.18	0.029	0.15	
Anthracene <sup>15</sup>	24900		3900				22000	100000	
Benzene <sup>15</sup>	230	6.4	0.02		0.1	1.4	0.67	1.5	
Benzo (a) anthracene <sup>15</sup>	9		5.5				0.62	2.9	
Benzo (b) fluoranthene <sup>15</sup>	9		17		0.1	1	0.62	2.9	
Benzo (k) fluoranthene <sup>15</sup>	93		170		0.1	1	6.2	29	
Benzoic acid	332000		350				100000	100000	
Benzo (a) pyrene <sup>15</sup>	0.9		2.4		0.1	0.1	0.062	0.09	
Bis (2-chlorethyl) ether	6	2.4	0.002				0.21	0.62	
Bis (2-ethylhexyl) phthalate	490		1100		32	210	35	180	
Bromodichloromethane	110		0.3				1	2.4	
Bromoform	860	370	0.34				62	310	
Butanol	8300		9				6100	88000	
2-Butanone					48000	48000	7300	28000	
Butyl benzyl phthalate	16600		5000				12000	100000	
Carbazole	340		2				24	120	
Carbon disulfide	8300	453 <sup>12</sup>	16				360	720	
Carbon tetrachloride	52	2.6	0.03				0.24	0.53	
Chlordane	5	100	3				1.6	11	
p-Chloroaniline	330		0.46				2.4	3500	
Chlorobenzene	1700	81	0.5				150	540	
Chlorodibromomethane	80		0.2						
Chloroform	830	2.4	0.3				0.24	0.52	
2-Chlorophenol	415		1.3				0.63	240	
Chrysene <sup>15</sup>	930		550				62	290	
DDD	28		42				2.4	17	
DDE	20		130				1.7	12	
DDT	20	3900	80		1.7	13	1.7	12	
Dibenzo (ash) anthracene <sup>15</sup>	0.9		5				0.062	0.29	
Di-n-butyl phthalate	8300		1500		8000	8000	6100	88000	
Di-n-octyl phthalate	1700		720000				1200	10000	

# ADDENDUM TABLE 1

				Metlakatla Indian		EPA		
	ADEC - TABLE B1. METHOD TWO -			Community		Region 9		
	SOIL CLEANUP LEVELS TABLE			Soil Cleanup		PRGs		
				Levels				
	Over 40 inch Zone <sup>3</sup>							
CHEMICAL NAME	Ingestion	Inhalation	Migration to	Residential	Industrial	Residential	Industrial	Reporting
(Carcinogens in Bold Type)	(mg/kg)	(mg/kg)	Groundwater	(mg/kg)	(mg/kg)	Soil	Soil	Limit
			(mg/kg)			(mg/kg)	(mg/kg)	
ORGANICS								
1,2-Dichlorobenzene	7500	110 <sup>12</sup>	6	6	7500	370	370	
1,4-Dichlorobenzene	280	6000	0.7	0.7	280	3.4	8.1	
3,3-Dichlorobenzidine	15		0.02			1.1	5.5	
1,1-Dichloroethane	8300	890 <sup>12</sup>	11			590	2100	
1,2-Dichloroethane	75	3.5	0.01			0.35	0.76	
1,1-Dichloroethylene	11	0.65	0.03			0.054	0.12	
cis-1,2-Dichloroethylene	830		0.2			43	150	
Trans-1,2-Dichloroethylene	1700		0.34			63	210	
2,4-Dichlorophenol	250		0.45			180	2600	
1,2-Dichloropropane	100	12	0.015			0.35	0.77	
1,3-Dichloropropene	25	1	0.02			0.082	0.18	
Dieldrin	0.4	6	0.014			0.03	0.15	
Dimethyl phthalate	830000		1200			100000	100000	
Diethyl phthalate	66000		170			49000	100000	
2,4-Dimethylphenol	1700		3.6			1200	18000	
2,4-Dinitrophenol	170		0.17			120	1800	
2,4-Dinitrotoluene	10		0.0044			120	1800	
2,6-Dinitrotoluene	10		0.004			61	880	
Dioxin <sup>8</sup>						0.0000039	0.000027	
Endosulfan	500		6			370	5300	
Endrin	25		0.3			18	260	
Ethylbenzene <sup>15</sup>	8300	89 <sup>12</sup>	5	20	230	230	230	
Ethylene Dibromide								
Fluoranthene	3300		1900	1900	8000	2300	30000	
Fluorene <sup>15</sup>	3300		240			2600	33000	
Heptachlor	1.5	0.6	7			0.11	0.55	
Heptachlor epoxide	0.75	25	0.2			0.053	0.27	
Hexachlorobenzene	4	5	0.7	0.28	1.9	0.3	1.5	
Hexachloro-1,3-butadiene	17	41	7			6.2	32	
alpha-BHC	1	4	0.002			0.09	0.59	
beta-BHC	4	32	0.008			0.32	2.1	
Lindane	5		0.003			0.44	2.9	

### ADDENDUM TABLE 1

				Metlakatla Indian		EPA		
	ADEC - TABLE B1. METHOD TWO -			Community		Region 9		
	SOIL CLEANUP LEVELS TABLE			Soil Cleanup		PRGs		
				Levels				
	Over 40 inch Zone <sup>3</sup>							
CHEMICAL NAME	Ingestion	Inhalation	Migration to	Residential	Residential	Industrial	Residential	Reporting
(Carcinogens in Bold Type)	(mg/kg)	(mg/kg)	Groundwater	(mg/kg)	Soil	Soil	Soil	Limit
			(mg/kg)		(mg/kg)	(mg/kg)	(mg/kg)	
<b>ORGANICS</b>								
Hexachloro-cyclopentadiene	580	5	120			420	5900	
<b>Hexachloroethane</b>	83	290	1.4			35	180	
<b>Indeno(1,2,3-c,d)pyrene <sup>15</sup></b>	9		50			0.62	2.9	
<b>Isophorone</b>	7200		2.6		510	2600	510	
Methoxychlor	420		47		310	4400	310	
Methyl bromide	120	11	0.14					
<b>Methylene chloride</b>	900	135	0.01	8.5	8.9	21	8.9	
2-Methylphenol (o-cresol)	4200		6		3100	44000	3100	
<b>Naphthalene <sup>15</sup></b>	3300		38	30	56	190	56	
Nitrobenzene	42	67	0.06		20	110	20	
<b>n-Nitrosodiphenylamine</b>	1400		3		99	500	99	
<b>n-Nitrosodin-propylamine</b>	1		0.0003		0.069	0.35	0.069	
<b>n-Propylbenzene</b>				130	140	240	140	
<b>Pentachlorophenol</b>	28 <sup>13</sup>		0.009		3	11	3	
Phenol	50000		60		37000	100000	37000	
<b>PCBs <sup>9</sup></b>	10	10	10	0.08	0.22	1	0.22	
<b>Pyrene <sup>15</sup></b>	2500		1400	1400	2300	54000	2300	
Styrene	17000	280 <sup>12</sup>	1.2		1700	1700	1700	
<b>1,1,2,2-Tetrachloroethane</b>	34	4	0.01		0.8	0.9	0.38	
<b>Tetrachloroethylene</b>	130	79	0.025		5.7	19	5.7	
<b>Toluene <sup>15</sup></b>	17000	180 <sup>12</sup>	4.8	40	520	520	520	
<b>Toxaphene</b>	6	460	9		0.44	2.2	0.44	
<b>1,2,4-Trichlorobenzene</b>	830	570 <sup>12</sup>	1.7	480	650	3000	650	
1,1,1-Trichloroethane		460 <sup>12</sup>	0.9		770	1400	770	
<b>1,1,2-Trichloroethane</b>	120	8	0.015		0.84	1.9	0.84	
<b>Trichloroethylene</b>	620	32	0.02		2.8	6.1	2.8	
2,4,5-Trichlorophenol	8300		78		6100	88000	6100	
<b>2,4,6-Trichlorophenol</b>	620	1100	0.5		44	220	44	
<b>1,2,4-Trimethylbenzene</b>				51	5.7	5.7	5.7	
<b>1,3,5-Trimethylbenzene</b>				21	21	70	21	
Vinyl acetate	83000	1100	90		430	1400	430	
<b>Vinyl chloride (Chloroethene)</b>	4	0.3	0.008		0.022	0.049	0.022	
<b>Xylenes (total) <sup>15</sup></b>	166000	81 <sup>12</sup>	69	20	210	210	210	

**ADDENDUM TABLE 1**

				Metlakatla Indian		EPA		
	ADEC - TABLE B1. METHOD TWO -			Community		Region 9		
	SOIL CLEANUP LEVELS TABLE			Soil Cleanup		PRGs		
				Levels				
	Over 40 inch Zone <sup>3</sup>							
CHEMICAL NAME	Ingestion	Inhalation	Migration to	Residential	Industrial	Residential	Industrial	Reporting
(Carcinogens in Bold Type)	(mg/kg)	(mg/kg)	Groundwater	(mg/kg)	(mg/kg)	Soil	Soil	Limits
			(mg/kg)			(mg/kg)	(mg/kg)	
INORGANICS								
Antimony	33		3			31		
Arsenic	4.5		1.8			0.39		
Barium	5800		982	982	5800	5400		
Beryllium	1.6		38			150		
Cadmium	83		4.5	4.5	83	37		
Chromium (Total)	420		23	100	450	210		
Chromium +3	83000		>1000000			100000		
Chromium +6	420		23			30		
Cyanide <sup>10</sup>	1700		24			1200		
Lead <sup>11</sup>				200	1000	400		
Tetraethyl Lead						0.0061		
Mercury		13	1.24	22	560	23		
Nickel	1700		78			1600		
Selenium	420		3			390		
Silver	420		19	40	9400	390		
Vanadium	580		3050			550		
Zinc	25000		8100			23000		
PETROLEUM HYDROCARBON RANGE								
C6-C10 GRO using AK 101	1400	1400	260	100	100			
C10-C25 DRO using AK 102	8250	12500	230	200	500			
C25-C36 RRO using AK 103	8300	22000	9700	200	500			

The ADEC Matrix Score for Annette is between 27 and 40, placing cleanup levels in Category B.

Category B Cleanup Levels for DRO-200 mg/kg, GRO-100mg/kg and RRO-2000 mg/kg. Compounds in **red** are MIC CoCs.

Items **Highlighted** in Tan are the most conservative of the three cleanup levels identified.

## ADDENDUM TABLE 2 SOILS

SOIL TABLE				
CAS	CHEMICAL NAME	<i>Most Stringent</i>	<b>Analytical</b>	<b>Reporting</b>
NUMBER <sup>4</sup>	(Carcinogens in Bold Type)	<b>Cleanup Level</b>	<b>Method</b>	<b>Limit</b>
		(mg/Kg)	SW-846	(mg/Kg)
	<b>ORGANICS</b>			
1332-21-4	Asbestos	<1%	40 CFR 763 Subpart E	1%
83-32-9	Acenaphthene <sup>15</sup>	190	8270	0.01
67-64-1	Acetone (2-Propanone)	9	8260B	2
309-00-2	<b>Aldrin</b>	0.03	8081A	0.001
120-12-7	Anthracene <sup>15</sup>	3900	8270	0.01
71-43-2	<b>Benzene</b> <sup>15</sup>	0.02	8260B	0.0004
56-55-3	<b>Benzo(a)anthracene</b> <sup>15</sup>	0.62	8270	0.01
205-99-2	<b>Benzo(b)fluoranthene</b> <sup>15</sup>	0.1	8270	0.01
207-08-9	<b>Benzo(k)fluoranthene</b> <sup>15</sup>	0.1	8270	0.01
65-85-0	Benzoic acid	350	8270C	0.05
50-32-8	<b>Benzo(a)pyrene</b> <sup>15</sup>	0.062	8270	0.01
111-44-4	<b>Bis(2-chlorethyl)ether</b>	0.002	8270C	0.05
117-81-7	<b>Bis(2-ethylhexyl)phthalate</b>	32	8270C	0.05
75-27-4	<b>Bromodichloromethane</b>	0.3	8260B	0.0004
75-25-2	<b>Bromoform</b>	0.34	8260B	0.0004
71-36-3	Butanol	9	8260B	40
78933	2-Butanone	7300	8260B	0.0004
85-68-7	Butyl benzyl phthalate	5000	8270C	0.05
86-74-8	<b>Carbazole</b>	2		
75-15-0	Carbon disulfide	16	8260B	0.0004
56-23-5	<b>Carbon tetrachloride</b>	0.03	8260B	0.0004
57-74-9	<b>Chlordane</b>	1.6	8081A	0.01
106-47-8	p-Chloroaniline	0.46		0.05
108-90-7	Chlorobenzene	0.5	8260B	0.0004
124-48-1	<b>Chlorodibromomethane</b>	0.2	8260B	0.0004
67-66-3	<b>Chloroform</b>	0.24	8260B	0.0004
95-57-8	2-Chlorophenol	0.63	8270C	0.05
218-01-9	<b>Chrysene</b> <sup>15</sup>	62	8270	0.01
72-54-8	<b>DDD</b>	2.4	8081A	
72-55-9	<b>DDE</b>	1.7	8081A	0.002
50-29-3	<b>DDT</b>	1.7	8081A	0.002
53-70-3	<b>Dibenzo(a,h)anthracene</b> <sup>15</sup>	0.062	8270	0.002
84-74-2	Di-n-butyl phthalate	1500	8270C	0.05
117-84-0	Di-n-octyl phthalate	1200	8270C	0.05

## ADDENDUM TABLE 2 SOILS

SOIL TABLE				
CAS	CHEMICAL NAME	Most Stringent	Analytical	Reporting
NUMBER <sup>4</sup>	(Carcinogens in Bold Type)	Cleanup Level	Method	Limit
		(mg/Kg)	SW-846	(mg/Kg)
	<b>ORGANICS</b>			
95-50-1	1,2-Dichlorobenzene	6	8260B	0.0004
106-46-7	<b>1,4-Dichlorobenzene</b>	0.7	8260B	0.0004
91-94-1	<b>3,3-Dichlorobenzidine</b>	0.02	8270C	0.05
75-34-3	1,1-Dichloroethane	11	8260B	0.0004
107-06-2	<b>1,2-Dichloroethane</b>	0.01	8260B	0.0004
75-35-4	<b>1,1-Dichloroethylene</b>	0.03	8260B	0.0004
156-59-2	cis-1,2-Dichloroethylene	0.2	8260B	0.0004
156-60-5	Trans-1,2-Dichloroethylene	0.34	8260B	0.0004
120-83-2	2,4-Dichlorophenol	0.45	8270C	0.05
78-87-5	<b>1,2-Dichloropropane</b>	0.015	8260B	0.0004
542-75-6	<b>1,3-Dichloropropene</b>	0.02	8260B	0.0004
60-57-1	<b>Dieldrin</b>	0.014	8081A	0.002
131-11-3	Dimethyl phthalate	1200	8270C	0.05
84-66-2	Diethyl phthalate	170	8270C	0.05
105-67-9	2,4-Dimethylphenol	3.6	8270C	0.05
51-28-5	2,4-Dinitrophenol	0.17	8270C	0.05
121-14-2	<b>2,4-Dinitrotoluene</b>	0.0044	8270C	0.05
606-20-2	<b>2,6-Dinitrotoluene</b>	0.004	8270C	0.05
174-60-16	<b>Dioxin</b> <sup>8</sup>	0.0000039		
115-29-7	Endosulfan	6	8081A	0.002
72-20-8	Endrin	0.3	8081A	0.002
100-41-4	Ethylbenzene <sup>15</sup>	5	8151A	0.0004
106-93-4	Ethylene Dibromide	0.0069		
206-44-0	Fluoranthene	1900	8270	0.01
86-73-7	Fluorene <sup>15</sup>	240	8270	0.01
76-44-8	<b>Heptachlor</b>	0.11	8081A	0.001
1024-57-3	<b>Heptachlor epoxide</b>	0.053	8081A	0.001
118-74-1	<b>Hexachlorobenzene</b>	0.28	8270C	0.05
87-68-3	<b>Hexachloro-1,3-butadiene</b>	6.2	8270C	0.05
319-84-6	<b>alpha-BHC</b>	0.002	8081A	0.001
319-85-7	<b>beta-BHC</b>	0.008	8081A	0.001
58-89-9	<b>Lindane</b>	0.003	8081A	0.001
77-47-4	Hexachloro-cyclopentadiene	5*	8270C	0.05
67-72-1	<b>Hexachloroethane</b>	1.4	8270C	0.05
193-39-5	<b>Indeno(1,2,3-c,d)pyrene</b> <sup>15</sup>	0.62	8270	0.01

## ADDENDUM TABLE 2 SOILS

SOIL TABLE				
CAS	CHEMICAL NAME	Most Stringent	Analytical	Reporting
NUMBER <sup>4</sup>	(Carcinogens in Bold Type)	Cleanup Level	Method	Limit
		(mg/Kg)	SW-846	(mg/Kg)
	<b>ORGANICS</b>			
78-59-1	<b>Isophorone</b>	2.6	8270C	0.05
72-43-5	Methoxychlor	47		0.01
74-83-9	Methyl bromide	0.14	8260B	0.0004
75-09-2	<b>Methylene chloride</b>	0.01	8260B	0.0004
95-48-7	2-Methylphenol (o-cresol)	6		0.05
91-20-3	Naphthalene <sup>15</sup>	30	8270	0.01
98-95-3	Nitrobenzene	0.06	8270C	0.05
86-30-6	<b>n-Nitrosodiphenylamine</b>	3	8270C	0.05
621-64-7	<b>n-Nitrosodin-propylamine</b>	0.0003	8270C	0.05
103651	n-Propylbenzene	130		
87-86-5	<b>Pentachlorophenol</b>	0.009	8270C	0.05
108-95-2	Phenol	60		0.05
133-63-63	<b>PCBs<sup>9</sup></b>	0.08	8082A	0.01
129-00-0	Pyrene <sup>15</sup>	1400	8270	0.01
100-42-5	Styrene	1.2	8260B	0.0004
79-34-5	<b>1,1,2,2-Tetrachloroethane</b>	0.01	8260B	0.0004
127-18-4	<b>Tetrachloroethylene</b>	0.025	8260B	0.0004
108-88-3	Toluene <sup>15</sup>	4.8	8260B	0.0004
8001-35-2	<b>Toxaphene</b>	0.44	8081A	0.1
120-82-1	1,2,4-Trichlorobenzene	1.7	8270C	0.05
71-55-6	1,1,1-Trichloroethane	0.9	8260B	0.0004
79-00-5	<b>1,1,2-Trichloroethane</b>	0.015	8260B	0.0004
79-01-6	<b>Trichloroethylene</b>	0.02	8260B	0.0004
95-95-4	2,4,5-Trichlorophenol	78	8151A	0.008
88-06-2	<b>2,4,6-Trichlorophenol</b>	0.5	8151A	0.017
95636	1,2,4-Trimethylbenzene	5.7	8260B	0.0004
108678	1,3,5-Trimethylbenzene	21	8260B	0.0004
108-05-4	Vinyl acetate	90		
75-01-4	<b>Vinyl chloride (Chloroethene)</b>	0.008	8260B	0.0004
1330-20-7	Xylenes (total) <sup>15</sup>	20	8260B	0.0012

## ADDENDUM TABLE 2 SOILS

SOIL TABLE				
CAS	CHEMICAL NAME	Most Stringent	Analytical	Reporting
NUMBER <sup>4</sup>	(Carcinogens in Bold Type)	Cleanup Level	Method	Limit
		(mg/Kg)	SW-846	(mg/kg)
	<b>INORGANICS</b>			
7440-36-0	Antimony	3	6020	3
7440-38-2	<b>Arsenic</b>	1.8	6020	1
7440-39-3	Barium	982	6020	1
7440-41-7	<b>Beryllium</b>	1.6**	6020	0.5
7440-43-9	Cadmium	4.5	6020	0.5
7440-47-3	Chromium (Total)	23	6020	1
16065-83-1	Chromium +3	83000**		
18540-29-9	Chromium +6	23		
57-12-5	Cyanide <sup>10</sup>	24	335. 3 mod	20
7439-92-1	Lead <sup>11</sup>	200	6020	0.5
7439-97-6	Mercury	1.24	7471A	0.1
7440-02-0	Nickel	78	6020	1
7782-49-2	Selenium	3	6020	3
7440-22-4	Silver	19	6020	0.5
7440-62-2	Vanadium	580**	6020	1
7440-66-6	Zinc	8100	6020	4
	<b>PETROLEUM HYDROCARBON RANGE</b>			
	C6-C10 GRO using AK 101	100		2
	C10-C25 DRO using AK 102	200		33
	C25-C36 RRO using AK 103	200		40

\* - Based on ADEC cleanup level for inhalation.

\*\* - Based on ADEC cleanup level for ingestion.

### Color Code

MIC Cleanup Level

Region 9 PRG

ADEC Cleanup Level

Federal MCL



ADDENDUM TABLE 3 GROUNDWATER

GROUNDWATER TABLE					
	NRWQ	CAS Registry Number	Most Stringent Cleanup Level	Analytical Method	Reporting Limit
Hazardous Substance	(ug/L)		(ug/L)		(ug/L)
Asbestos	7 million fibers/L		7 million fibers/L <sup>A</sup>	600/44-83-043	7 million fibers/L <sup>A</sup>
Acenaphthene		83-32-9	365	8270	0.01
Acetone		67-64-1	610	8260B	2
Aldrin		309-00-2	0.00013	8081A	0.01
Anthracene		120-12-7	1800	8270	0.01
Antimony	14000	7440-36-0	6 <sup>A</sup>	6020	3
Alachlor		15972-60-8	2 <sup>B</sup>		
Arsenic		7440-38-2	50 <sup>B</sup>	6020	1
Atrazine		1912249	3 <sup>B</sup>		
Barium		7440-39-3	1000	6060	1
Benzene		71-43-2	1.2 <sup>C</sup>	8260B	0.4
Benzo(a)anthracene	0.0044	56-55-3	0.092	8270C	0.01
Benzo(b)fluoranthene		205-99-2	0.0044	8270	0.01
Benzo(k)fluoranthene		207-08-9	0.0044	8270C	0.01
Benzoic acid		65-85-0	146000	8270C	0.05
Benzo(a)pyrene		50-32-8	0.0044 <sup>C</sup>	8270	0.01
Beryllium		2023552	4 <sup>A</sup>	6020	0.05
Bis(2-chloroethyl)ether		111-44-4	0.0098	8270C	0.05
Bis(2-ethylhexyl)phthalate		117-81-7	1.8	8270C	1
Bromodichloromethane	56	75-27-4	0.18	8260B	0.4
Bromoform (Tribromomethane)	4.3	75-25-2	8.5	8260B	0.4
Butanol		71-36-3	3650	8260B	1000
Butyl benzyl phthalate		85-68-7	7300	8270C	1
Cadmium		7440-04-39	2.2 <sup>C</sup>	6020	0.5
Carbazole		86-74-8	3.4		
Carbon disulfide		75-15-0	1000	8206B	0.4
Carbon tetrachloride	2.5	56-23-5	5 <sup>A,B</sup>	8260B	0.4
Chlordane	0.21	57-74-9	2 <sup>A,B</sup>	8081A	0.1
p-Chloroaniline		106-47-8	150	8270C	0.05
Chlorobenzene		108-90-7	100 <sup>A</sup>	8260B	0.4
Chlorodibromomethane	0.41	124-48-1	60	8260B	0.4
Chloroform		67-66-3	0.16	8260B	0.4
2-Chlorophenol		95-57-8	30	8270C	0.05
Chromium (Total)		7440-47-3	100 <sup>A</sup>	6020	1

ADDENDUM TABLE 3 GROUNDWATER

GROUNDWATER TABLE					
	NRWQ	CAS Registry Number	Most Stringent Cleanup Level	Analytical Methods	Reporting Limit
Hazardous Substance	(ug/L)		(ug/L)		(ug/L)
Chromium +3		16065-83-1	36500		
Chromium +6	1300	18540-29-9	100		
Chrysene	0.0044	218-01-9	9.2	8270C	0.01
Copper		2023573	1300 <sup>A</sup>	6020	1
Cyanide		57-12-5	200 <sup>A</sup>	335.3 MOD	0.2
DDD	0.00083	72-54-8	0.28	8081A	0.2
DDE	0.00059	72-55-9	0.2	8081A	0.2
DDT		50-29-3	0.0005	8081A	0.2
Dibenzo(a,h)anthracene	0.0044	53-70-3		8270	0.01
Di-n-butyl phthalate		84-74-2	2700	8270C	0.05
1,2-Dichlorobenzene		95-50-1	600 <sup>A,B</sup>	8270C	0.05
1,4-Dichlorobenzene		106-46-7	75 <sup>A,B</sup>	8270C	0.05
3,3-Dichlorobenzidine		91-94-1	0.15	8270C	0.5
1,1-Dichloroethane		75-34-3	810	8270C	0.4
1,2-Dichloroethane	0.38	107-06-2	5 <sup>A,B</sup>	8270C	0.4
1,1-Dichloroethylene	0.057	75-35-4	7 <sup>A,B</sup>	8270C	0.4
cis-1,2-Dichloroethylene		156-59-2	70 <sup>A,B</sup>	8270C	0.4
trans-1,2-Dichloroethylene		156-60-5	100 <sup>A</sup>	8270C	0.4
2,4-Dichlorophenol	93	120-83-2	100	8270C	0.05
1,2-Dichloropropane	0.52	78-87-5	5 <sup>A,B</sup>	8260B	0.4
Dichloromethane		75-09-2	5		
1,3-Dichloropropene		542-75-6	0.081	8260B	0.4
Dieldrin		60-57-1	0.0042	8081A	0.02
Diethyl phthalate		84-66-2	6	8270C	0.05
2,4-Dimethylphenol	540	105-67-9	700	8270C	0.05
2,4-Dinitrophenol		51-28-5	70	8270C	0.05
2,4-Dinitrotoluene	0.11	121-14-2	1.25	8270C	0.05
2,6-Dinitrotoluene		606-20-2	1.25	8270C	0.05
Di-n-octyl phthalate		117-84-0	700	8270C	0.05
Dioxin	0.000013	174-60-16	0.00003 <sup>A</sup>		
Endosulfan	110	115-29-7	200	8081A	0.01
Endrin	0.76	72-20-8	2 <sup>A</sup>	8081A	0.02
Ethyl benzene		100-41-4	700 <sup>A</sup>	8021A/8260B	1
Ethylene dibromide		106-93-4	0.05 <sup>B</sup>		
Fluoranthene		206-44-0	300	8270/8270C	0.01
Fluorene		86-73-7	240	8270/8270C	0.01

**ADDENDUM TABLE 3 GROUNDWATER**

<b>GROUNDWATER TABLE</b>					
	<b>NRWQ</b>	<b>CAS Registry Number</b>	<b>Most Stringent Cleanup Level</b>	<b>Analytical Method</b>	<b>Reporting Limit</b>
<b>Hazardous Substance</b>	<b>(ug/l)</b>		<b>(ug/L)</b>		<b>(ug/L)</b>
<b>Heptachlor</b>	0.00021	76-44-8	0.4 <sup>A,B</sup>	8081A	0.01
<b>Heptachlor epoxide</b>		1024-57-3	0.2 <sup>A,B</sup>	8081A	0.01
<b>Hexachlorobenzene</b>	0.0001	118-74-1	0.00075 <sup>C</sup>	8270C	0.05
<b>Hexachloro-1,3-butadiene</b>	0.44	87-68-3	0.86	8270C	0.05
<b>alpha-Hexachlorocyclohexane</b>	0.0039	319-84-6	0.011	8081A	0.01
<b>beta-Hexachlorocyclohexane</b>	0.0014	319-85-7	0.037	8081A	0.01
<b>gamma-Hexachloro-- cyclohexane (Lindane)</b>	0.014	58-89-9	0.2 <sup>A,B</sup>	8081A	0.01
<b>Hexachlorocyclopentadiene</b>		77-47-4	50	8270C	0.05
<b>Hexachloroethane</b>	1.9	67-72-1	4.8	8270C	0.05
<b>Indeno(1,2,3-c,d)pyrene</b>	0.0044	193-39-5	0.092	8270	0.01
<b>Isophorone</b>	36	78-59-1	71		0.05
<b>Lead</b>		7439-92-1	2.5 <sup>C</sup>	6020	1
<b>Mercury</b>		7439-97-6	0.05 <sup>C</sup>	7470A	0.0002
<b>Methoxychlor</b>		72-43-5	40 <sup>A</sup>	8081A	1
<b>Methyl bromide</b>	0.48	74-83-9		8260B	
<b>Methylene chloride</b>		75-09-2	4.7	8260B	0.4
<b>2-Methylphenol (o-cresol)</b>		95-48-7	1800	8270C	0.05
<b>Naphthalene</b>		91-20-3	6.2	8270C	0.01
<b>Nickel</b>		7440-02-0	100	6020	1
<b>Nitrobenzene</b>	0.7	98-95-3	3.4	8270C	0.05
<b>n-Nitrosodiphenylamine</b>	5	86-30-6	14	8270C	0.01
<b>n-Nitrosodi-n-propylamine</b>	0.005	621-64-7	0.0096	8270C	0.05
<b>Pentachlorophenol</b>	0.28	87-86-5	1 <sup>A,B</sup>	8270C	0.05
<b>Phenol</b>	21000	108-95-2	22000	8270C	0.05
<b>Polychlorinated biphenyls (PCBs)</b>		133-63-63	0.00017 <sup>C</sup>	8082A	0.1
<b>Pyrene</b>		129-00-0	180	8270	0.01
<b>Selenium</b>		7782-49-2	50 <sup>A,B</sup>	6020	3
<b>Silver</b>		7440-22-4	3.4	6020	0.5
<b>Styrene</b>		100-42-5	100 <sup>A</sup>	8260B	0.4
<b>1,1,2,2-Tetrachloroethane</b>		79-34-5	0.055	8260B	0.4
<b>Tetrachloroethylene</b>	0.8	127-18-4	5 <sup>A,B</sup>	8260B	0.4
<b>Thallium</b>	1.7	7440280	2 <sup>A</sup>	6020	0.5
<b>Toluene</b>		108-88-3	1000 <sup>A,B</sup>	8260B	0.4
<b>Toxaphene</b>		8001-35-2	3 <sup>A,B</sup>	8081A	1

ADDENDUM TABLE 3 GROUNDWATER

GROUNDWATER TABLE					
	NRWQ	CAS Registry Number	Most Stringent Cleanup Level	Analytical Method	Reporting Limit
Hazardous Substance	(ug/l)		(ug/L)		(ug/L)
1,2,4-Trichlorobenzene		120-82-1	70 <sup>A</sup>	8270C	0.05
1,1,1-Trichloroethane		71-55-6	200 <sup>A</sup>	8260B	0.4
<b>1,1,2-Trichloroethane</b>	0.6	79-00-5	5 <sup>A,B</sup>	8260B	0.4
<b>Trichloroethylene</b>	2.7	79-01-6	5 <sup>A,B</sup>	8260B	0.4
2,4,5-Trichlorophenol		95-95-4	3650	8270C	0.1
<b>2,4,6-Trichlorophenol</b>	2.1	88-06-2	6.1	8270C	0.2
Vanadium		74400622	260	6020	1
Vinyl acetate		108-05-4	410		
<b>Vinyl chloride (Chloroethene)</b>		75-01-4	2 <sup>A,B</sup>		0.4
Xylenes (total)		1330-20-7	10 <sup>A,B</sup>		1.2
Zinc	9.1	7440-66-6	11		4
<b>Petroleum Hydrocarbons</b>					
GRO - C6 - C10 (AK 101)		1		AK101	50
DRO - C10 - C25 (AK 102)		1		AK102	100
RRO - C25 - C36		1		AK103	100

Contaminate Level (MCL)

<sup>c</sup> The Federal MCL is less stringent than MICs cleanup level.

**ADDENDUM TABLE 4 RECOMMENDED SAMPLE PREPARATION METHODS, CLEANUP  
METHODS, ANALYTICAL METHODS AND DETECTION LIMITS FOR SEDIMENTS**

Chemical	Recommended Sample Preparation Methods <sup>a</sup>	Recommended Sample Cleanup Methods <sup>b</sup>	Recommended Analytical Methods <sup>c</sup>	Recommended Maximum Detection Limits <sup>d, i</sup> (µg/kg dry weight)
Metals				
Antimony	PSEP	--	6010/7041	50,000
Arsenic	PSEP	--	6010/7061	19,000
Cadmium	PSEP	--	6010/7131	1,700
Chromium	PSEP	--	6010/7191	87,000
Copper	PSEP	--	6010	130,000
Lead	PSEP	--	6010/7421	150,000
Mercury	-- <sup>e</sup>	--	7471	140
Nickel	PSEP		6010	47,000
Silver	PSEP	--	6010	2,000
Zinc	PSEP	--	6010	137,000
Nonionizable Organic Compounds				
LPAH Compounds				
Naphthalene	3540/3550	3640/3660	8270/1625C	700
Acenaphthylene	3540/3550	3640/3660	8270/1625C	433
Acenaphthene	3540/3550	3640/3660	8270/1625C	167
Fluorene	3540/3550	3640/3660	8270/1625C	180
Phenanthrene	3540/3550	3640/3660	8270/1625C	500
Anthracene	3540/3550	3640/3660	8270/1625C	320
2-Methylnaphthalene	3540/3550	3640/3660	8270/1625C	223
HPAH Compounds				
Fluoranthene	3540/3550	3640/3660	8270/1625C	567
Pyrene	3540/3550	3640/3660	8270/1625C	867
Benz[a]anthracene	3540/3550	3640/3660	8270/1625C	433
Chrysene	3540/3550	3640/3660	8270/1625C	467
Total benzofluoranthenes <sup>f</sup>	3540/3550	3640/3660	8270/1625C	1067
Benzo[a]pyrene	3540/3550	3640/3660	8270/1625C	533
Indeno[1,2,3-cd]pyrene	3540/3550	3640/3660	8270/1625C	200
Dibenz[a,h]anthracene	3540/3550	3640/3660	8270/1625C	77
Benzo[ghi]perylene	3540/3550	3640/3660	8270/1625C	223
Chlorinated Benzenes				
1,2-Dichlorobenzene	3540/3550	3640/3660	8270/1625C/8240	35
1,3-Dichlorobenzene	3540/3550	3640/3660	8270/1625C/8240	57
1,4-Dichlorobenzene	3540/3550	3640/3660	8270/1625C/8240	37
1,2,4-Trichlorobenzene	3540/3550	3640/3660	8270/1625C/8240	31
Hexachlorobenzene	3540/3550	3640/3660	8270/1625C	22
Phthalate Esters				

**ADDENDUM TABLE 4 RECOMMENDED SAMPLE PREPARATION METHODS, CLEANUP  
METHODS, ANALYTICAL METHODS AND DETECTION LIMITS FOR SEDIMENTS**

Chemical	Recommended Sample Preparation Methods <sup>a</sup>	Recommended Sample Cleanup Methods <sup>b</sup>	Recommended Analytical Methods <sup>c</sup>	Recommended Maximum Detection Limits <sup>d, i</sup> (µg/kg dry weight)
Miscellaneous Extractable Compounds				
Dimethyl phthalate	3540/3550	3640/3660	8270/1625C	24
Diethyl phthalate	3540/3550	3640/3660	8270/1625C	67
Di-n-butyl phthalate	3540/3550	3640/3660	8270/1625C	467
Butyl benzyl phthalate	3540/3550	3640/3660	8270/1625C	21
Dibenzofuran	3540/3550	3640/3660	8270/1625C	180
Hexachlorobutadiene	3540/3550	3640/3660	8270/1625C	11
Hexachloroethane	3540/3550	3640/3660	8270/1625C	47
N-nitrosodiphenylamine	3540/3550	3640/3660	8270/1625C	28
PCBs				
PCB Aroclors®	3540/3550	3620/3640/3660	8080	6
Chlorinated Pesticides				
DDD	3540/3550	3620/3640/3660	8080	3.3
DDE	3540/3550	3620/3640/3660	8080	2.3
DDT	3540/3550	3620/3640/3660	8080	6.7
Aldrin	3540/3550	3620/3640/3660	8080	1.7
Chlordane	3540/3550	3620/3640/3660	8080	1.7
Dieldrin	3540/3550	3620/3640/3660	8080	2.3
Heptachlor	3540/3550	3620/3640/3660	8080	1.7
Lindane	3540/3550	3620/3640/3660	8080	1.7
Volatile Organic Compounds				
Ethylbenzene	-- <sup>g</sup>	--	8240/1624C	3.2
Tetrachloroethene	-- <sup>g</sup>	--	8240/1624C	3.2
Total xylene	-- <sup>g</sup>	--	8240/1624C	3.2
Trichloroethene	-- <sup>g</sup>	--	8240/1624C	3.2
Ionizable Organic Compounds				
Phenol	3540/3550	3640/3660	8270/1625C	140
2-Methylphenol	3540/3550	3640/3660	8270/1625C	63
4-Methylphenol	3540/3550	3640/3660	8270/1625C	223
2,4-Dimethylphenol	3540/3550	3640/3660	8270/1625C	29
Pentachlorophenol	3540/3550	3640/3660	8270/1625C	120
Benzyl alcohol	3540/3550	3640/3660	8270/1625C	57
Benzoic acid	3540/3550	3640/3660	8270/1625C	217
Conventional Sediment Variables				
Ammonia	-- <sup>h</sup>	--	Plumb (1981)	100
Grain size	-- <sup>h</sup>	--	Plumb (1981)	1%
Total solids	-- <sup>h</sup>	--	PSEP	0.1% (wet wt)

Chemical	Recommended Sample Preparation Methods <sup>a</sup>	Recommended Sample Cleanup Methods <sup>b</sup>	Recommended Analytical Methods <sup>c</sup>	Recommended Maximum Detection Limits <sup>d, i</sup> (µg/kg dry weight)
Total organic carbon (TOC)	-- <sup>h</sup>	--	9060	0.1%
Total sulfides	-- <sup>h</sup>	--	Plumb (1981)/9030	100

**Note:**

- EPA - U. S. Environmental Protection Agency
- GPC - gel permeation chromatography
- HPAH - high molecular weight polycyclic aromatic hydrocarbon
- LPAH - low molecular weight polycyclic aromatic hydrocarbon
- PCB - polychlorinated biphenyl
- PSEP - Puget Sound Estuary Program
- TOC - total organic carbon

<sup>a</sup> Recommended sample preparation methods are:

PSEP (1989a)

Method 3500 series - sample preparation methods from SW-846 (U. S. EPA 1986) and updates.

<sup>b</sup> Recommended sample cleanup methods are:

All sample extracts should be subjected to GPC cleanup in accordance with procedures specified by EPA SW-846 Method 3640. Special care should be used during GPC to minimize loss of analytes.

If sulfur is present in the samples (as is common in most marine sediments), cleanup procedures specified by EPA SW-846 Method 3660 should be used.

All PCB extracts should be subjected to florisil column cleanup as specified by EPA SW-846 Method 3620.

Additional cleanup procedures may be necessary on a sample-by-sample basis. Alternative cleanup procedures are described in PSEP (1989a) and U. S. EPA (1986).

<sup>c</sup> Recommended analytical methods are:

Method 6000, 7000, 8000, and 9000 series - analytical methods from SW-846 (U. S. EPA 1986) and updates

Method 1624C/1625C - isotope dilution method (U. S. EPA 1989)

Plumb (1981) - U. S. EPA/U. S. Army Corps of Engineers Technical Report EPA/CE-81-1

PSEP (1986a)

Acid volatile sulfide method for sediment (U. S. EPA 1991).

<sup>d</sup> To achieve the recommended detection limits for organic compounds, it may be necessary to use a larger sample size (approximately 100 g), a smaller extract volume for gas chromatography/mass spectrometry analyses (0.5 mL), and one of the recommended sample cleanup methods, as necessary, to reduce interference. Detection limits are on a dry-weight basis unless otherwise indicated. For sediment samples with low TOC, it may be necessary to achieve even lower detection limits for certain analytes in order to compare the TOC-normalized concentrations with applicable numerical criteria (see Table 1).

<sup>e</sup> The sample digestion method for mercury is described in the analytical method (Method 7471, SW-846 [U. S. EPA 1986] and updates).

<sup>f</sup> Total benzofluoranthenes represent the sum of the b, j, and k isomers.

<sup>g</sup> Sample preparation methods for volatile organic compound analyses are described in the analytical methods.

<sup>h</sup> Sample preparation methods for sediment conventional analyses are described in the analytical methods.

<sup>i</sup> The recommended maximum detection limits are based on a value equal to one third of the 1988 dry weight lowest apparent effects threshold value (LAET, Barrick et al 1988) except for the following chemicals: 1,2-dichlorobenzene, 1,2,4-trichlorobenzene, hexachlorobenzene, hexachlorobutadiene, n-nitrosodiphenylamine, 2-methylphenol, 2,4-dimethylphenol, and benzyl alcohol, for which the recommended maximum detection limit is equal to the full value of the 1988 dry weight LAET.